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DIVERSION VERSUS NAVIGATION.

Hydroelectric power and irrigation must often be provided by the same development, if the best results are to be obtained, in that great section of the United States between the Missouri River and the Pacific Coast.

This is well illustrated in the great electric power and irrigation project now under construction along the Salt River, near Roosevelt, about thirty miles from Phoenix, Ariz.

In this instance, as in many others, a large amount of power is required to pump the water from the river gorge up to the level of the great plains, and thus make it available for irrigation. A double service is thus exacted of the water, first to furnish power and second to fill the irrigating ditches. The development just mentioned includes a capacity of 4,400 horsepower and the irrigation of 40,000 acres of land, and here, as elsewhere, the irrigation project thus creates the demand for the power.

Some important legal questions have to be met, however, in the execution of a hydroelectric and irrigation project, and one of these is the effect of the diversion of the water on navigation.

Many of the rivers in the great Rocky Mountain region, such as the Missouri, the Red, the Rio Grande, the Colorado and the Columbia, are navigable for interstate commerce along their lower courses, and it is a question how far the interests of navigation will permit the diversion of their upper waters.

It is assumed here that state authority can be obtained to divert the water of a river for purposes of irrigation, but the Federal Government has paramount power over waters that carry interstate commerce, and so must be reckoned with in the matter. The striking feature of the situation is that the desired diversion of water from a river may occur hundreds of miles from the part that is navigable, and yet it is for the Federal Government to determine whether the diversion will be permitted, because the diversion must affect the flow of the river at all points below.

A case that involved these principles in their application to the Rio Grande River came before the United States Supreme Court some years ago. The Rio Grande rises in Colorado and flows 1,770 miles to the Gulf of Mexico, crossing New Mexico from north to south on the way. The project in this case was to develop a great power and irrigation system by the construction of a dam at a point called Elephant Butte,

about 125 miles above the city of El Paso, Texas, and 1,055 miles from the Gulf, by the creation of a very large storage reservoir, and by the use of ditches and pipe lines. A large part of the flow of the Rio Grande at the point where the dam was to be located had already been diverted for the purpose of irrigation, and the admitted purpose of the new development was to take all of the remaining water from the river.

In an action on behalf of the United States to prevent this intended diversion of water, it appeared that the Rio Grande is navigable by steamboat for about 350 miles from its mouth, and the complaint was that the proposed diversion of water would seriously reduce its capacity for navigation.

It also appeared that authority had been obtained from New Mexico where the dam and reservoir were to be constructed for the diversion of the water, and that the approval of the Secretary of the Interior had been secured on behalf of the United States to the plans.

The Supreme Court in its opinion said that the question to be considered was whether the corporation that proposed to build the dam had a right to seriously affect navigation by the diversion of the water at the point above. As to the right in general to divert water, and the power of a state over the matter it was said:

"The unquestioned rule of the common law was that every riparian owner was entitled to the continued natural flow of the stream. * * * * While this is undoubted, and the rule obtains in those States in the Union which have simply adopted the common law, it is also true that as to every stream within its dominion a State may change this common law rule and permit the appropriation of the flowing waters for such purposes as it deems wise."

Concerning this power of a state the Court further said:

"It is limited by the superior power of the General Government to secure the uninterrupted navigability of all navigable streams within the limits of the United States. In other words, the jurisdiction of the General Government over interstate commerce and its natural highways vests in that Government the right to take all needed measures to preserve the navigability of the navigable water courses of the country even against any state action."

As to the laws of the western states governing the diversion of water the Court further said:

"Nowithstanding the unquestioned rule of the common law in reference to the right of a lower riparian proprietor to insist upon the continuous flow of the stream as it was, and although there has been in all the Western States an adoption or recognition of the common law, it was early developed in their history that the mining industry in certain States, the reclamation of arid lands in others, compelled a departure from the common law rule, and justified an appropriation of flowing waters both for mining purposes and for the reclamation of arid lands, and there has come to be recognized in those States, by custom and by State legislation, a different rule—a rule which permits, under certain circumstances, the appropriation of the waters of a flowing stream for other than domestic purposes."

As an illustration of the rule, the Court pointed out that while the Hudson River is a part of the navigable waters of the United States, still the Croton River which contributed to the volume of the Hudson had been rightfully appropriated for domestic supply in New York city, as the navigability of the Hudson was not thereby disturbed.

On the other hand, if New York State should divert the waters of the Hudson above the limits of navigation so as to destroy its navigability, this action might be enjoined.

A NEW TYPE OF CENTRAL STATION SPECIALIST.

The advantages of co-operation never cease to be demonstrated in public utility enterprises. The conditions which surround the production, distribution and sale of electricity vary so much in different localities that whenever two central-station men come together the opportunity is present for each to learn something worth while from the other. The fundamental features of the work may be similar, but the local variants give life to every earnest conversation upon practical problems of daily service. This is one reason why attendance at conventions is so stimulating to those who attach themselves to the meetings and discussions in the endeavor to give and take as much as possible in the line of experiences and opinions. In the field of legislation and regulation by state commissions there is also opportunity for effective work by a number of interests along lines which few if any single companies could afford to follow.

A recent extension of this principle of co-operation into the power field merits the consideration of thoughtful station managers. Not a few of the smaller companies have found the work of power solicitation difficult and perhaps costly; the maintenance of one or two high-salaried employees giving their whole time to power solicitation has not always produced the results hoped for, especially in the face of local limitations of market and prejudices; and many times the most painstaking efforts to obtain and keep motor service have fallen short through the absence of a broad knowledge of power economies in the soliciting staff. Of course, in numerous other instances, power solicitation by small companies has been crowned with the most successful results. Out of the incompleteness and obstacles which have occupied the stage in many cases, however, has come an economic demand for a new type of central-station specialist, who can give a number of co-operating companies the benefit of a wide and deep experience, take command of difficult situations with a fair prospect of success and point out wherein progress can be made in the handling of established and anticipated customers' power situations.

In at least one case with which we are familiar a start has been made in this direction with the prospect of decided gains in the power earnings and profits of the companies which are availing themselves of specialized advice. To a certain

extent the work naturally follows that of the consulting electrical engineer making a specialty of industrial power problems, but it has this point of interest to the central station—the specialist in power service retained by one or more companies in the same general district makes a particular point of securing this business for the public utility corporations which employ him, and on the basis of a much wider experience than an ordinary company can afford to pay for in the form of a regular employee earning a relatively high income. That is, several companies, the number being immaterial, may combine to secure the supervision of the power specialist in connection with their new business departments; and the old staff of solicitors may be retained or removed as occasion dictates. The power specialist under this plan is retained for a moderate yearly sum per company, he maintains a general oversight and correspondence with his clients on the basis of this fee, and when his presence is demanded by difficult conditions or other factors, he visits the client at a per diem rate lower than many outside firms of engineers would charge.

So far as the work has gone in the instance in mind, the companies have received the benefits of broad experience in the handling of existing installations; established customers' plants have been improved in efficiency from twenty to thirty per cent; the solicitation of new business has been brought under the eyes of technical ability derived from many years of actual contact with the immediate problems of small motor applications in industrial plants; the making of contracts has been placed upon a standard basis; guaranteed results have been placed in front of the prospective consumer; the influence of the power load upon the economy of production at the power station itself has been recognized; and the client organizations have availed themselves of a source of data covering a wide variety of industrial applications much of the material being hitherto inaccessible to single companies. Experience is showing more and more that the securing and retention of power business must be handled upon an engineering basis. We hold no brief for the indiscriminate employment of consulting advice, but it is interesting and suggestive to consider the benefits which co-operating companies may secure in cases where the advisory expert's experience and charges are such as to enable a fair trial to be made of the methods outlined above.

EFFICIENT COAL HANDLING.

The importance of handling a central-station coal supply cheaply deserves continued emphasis. It is easy for a plant manager to concentrate his attention upon the utilization of fuel, but room exists for the reduction of expenses in transferring coal from car to furnace no less than in the passage of heat units from one part of the plant to another. Labor assigned to handle coal is inevitably costly in relation to the commodity dealt with, and anything which can be done to cut down the cost of attendance before the fuel reaches the firing aisle is well worth looking into if it does not involve heavy investment or disproportionate replacement expenses.

The power plant designer needs to follow the industrial plant builder a little closer in some aspects of fuel handling. In most modern factories where an extended process is carried on, the force of gravity is utilized at every possible turn. It has long been known that the cheapest of all means of transferring material from one point to another is to let it fall into the desired place, and yet in how many cases do we see coal being shovelled from cars to bins by a force of men representing a labor cost of from $4 to $8 per day! Most large plants appreciate this phase of the coal-handling problem, but there is room for great improvement among many of the smaller stations which are served by a railroad sidetrack or by a mere wagon-way at a poor relative level for delivery to the pockets. It not seldom happens that the investment of a comparatively small sum will result in the elimination of one or two handlings between the car and the boilers. If coal is brought to the plant by teams it is not a costly problem as a rule, given plenty of space, to build an inclined roadway or wooden trestle, or even an earth embankment, up which the cars or carts can be run, perhaps with the assistance of a small motor and windlass, thus providing for gravity dumping into the bins or pockets. What is needed is to get far away from the idea of shovelling coal up from the cars or wagon and thence down into the crusher or bin by mere muscular effort.

The total annual cost, including fixed charges, of operating an electric hoist or jib crane, or a locomotive crane, in a power plant consuming two or three thousand tons of coal per year should be less than the expense of handling by labor alone. Even a small hoist in a plant not using very large quantities of fuel per day will quickly pay for itself, for if its capacity is rather limited it can still be used regularly and thus deliver coal steadily while the demand of the furnaces may vary through wide ranges. It is safe to figure, usually, that self-clearing cars can be unloaded into a hopper for five or six cents per ton less than flat-bottom cars can be unloaded by hand. When a plant uses large quantities of fuel daily it is well to provide liberal storage space, not only to avoid interruptions and breaks in the service but also to escape the expense of storage in cars.

The low cost of handling fuel in power plants located on tide water is usually due to the installation of labor-saving machinery of the motor-driven type, so that the coal brought to the plant in barge or car can be transferred at a rapid rate between the latter and the pockets. There is good opportunity here to save power through the elimination of steam-driven hoists and the maintenance of conveyors in conditions of first-class lubrication. For small and medium sized plants there is a large field of usefulness for the electrically driven telpher systems now on the market. The economical handling of fuel depends upon the avoidance of large expenditures for equipment in small plants, upon the utilization of power-driven machinery in place of hand labor, and upon the fullest possible use of gravity.

Preliminary Arrangements for N. E. L. A. Convention.

President F. W. Freuauff, of the National Electric Light Association, visited St. Louis recently to confer with the local people there regarding the annual convention. He was accompanied by Frank H. Gale, chairman of the exhibition committee, and Messrs. McQuiston, Ayer, and Neumuller. The general conference was attended by Alton D. Miller, president of the Union Electric Light Company, and others representing the local interests. President Freuauff announced that St. Louis had been selected as the 1910 convention city, provided satisfactory arrangements could be made. Before President Freuauff and his associates left St. Louis they were satisfied with the facilities offered and the exhibition committee proceeded to arrange details for that part of the convention in which it was interested.

The last convention of the Association that was held in St. Louis was the sixteenth, in 1893, and was a memorably successful one. In going back seventeen years later, it is believed that equal or even greater success will attend the meetings this year, which marks the twenty-fifth anniversary of the Association.

St. Louis is very well equipped for the convention from the standpoint of hotel accommodations. The prominent hotels have an aggregate of nearly 4,000 rooms, of which from 1,800 to 2,000 will be available. The Hotel Men's Association, through its president, Colonel Lyman T. Hay, has assured the Association that neither directly nor indirectly will rates be increased. The end of May is a particularly attractive season at St. Louis and many forms of entertainment are available for the ladies.

The use of the Coliseum, a large new steel and concrete structure, has been tendered to the Association free of all cost. This building offers exceptional advantages for the meetings and the exhibition by the class "D" membership. Approximately ninety booths have been provided for the exhibits, averaging eighty-five square feet each.

The main convention hall will comfortably accommodate more than 1,000 people. In addition two other rooms, with a capacity of 400 and 250 respectively, are available for parallel sessions. The convention will be held during the week beginning May 23.

Elmer W. Gillmer Dead.

Elmer W. Gillmer, head of the Gillmer Interests at Warren, Ohio, died suddenly Saturday morning, February 19, of heart failure following an attack of acute indigestion.

Mr. Gillmer was born in Warren forty-eight years ago, and was one of the leading business men of the community. He was also president of the National Electric Lamp Association.

The funeral was held on Tuesday, February 22. The honorary pallbearers were: F. S. Terry, B. G. Tremaine, J. Robert Crouse, A. D. Page, S. E. Doane and L. P. Sawyer. A special car was run from Cleveland to Warren carrying a large number of prominent men to attend the services. The employees of Mr. Gillmer's various companies at Warren attended the funeral in a body.

Progress in the Arrangements for Chicago's Complete Electric Lighting.

A few months ago note was made in these columns of the tentative offer of the Sanitary District of Chicago to light all of the Chicago streets with electric lamps. At the present time the city has about 12,200 arc lamps in service for street lighting. It has been estimated that 10,000 additional ones will enable practically the complete lighting of every street and many of the alleys of the city.

On February 22 a conference was held by President R. R. McCormick of the Sanitary District board of trustees and several other officials of the District on the one side with a sub-committee of the city council finance committee. An offer was made by the district authorities to take over the entire lighting equipment, including substations, transmission and distribution lines both overhead and underground, as well as all the arc lamps and auxiliary equipment now in service for street lighting. The district is to change all the direct-current circuits into alternating-current circuits and to extend the lighting system by an addition of about 10,000 arc lamps. To pay for these extensions and changes the district will issue bonds, which it has authority to do, to the amount of between $1,750,000 and $2,000,000, the city to pay the interest on the bonds, and at some future date to be specified to pay back the principal. The district is also to receive compensation of $1.00 per year for each arc light served as a fixed charge, and an amount not to exceed $15.00 per horsepower year for all the current supplied to the lighting system as measured at the main distributing stations of the Sanitary District.

The proposition is looked upon very favorably by the city authorities, and very likely will be accepted by them.

President Vose Speaks in Cleveland.

Taking the Chicago Electric Club as an example, there has been organized in Cleveland a similar body to be known as the Electrical League of Cleveland.

It was therefore fitting that President Frederic P. Vose of the Chicago organization should be called upon to outline the policies, objects and results of such an organization for the benefit of the newer club.

At a meeting of the league on Friday, February 18, in the Assembly Room of the Hollenden Hotel, Mr. Vose explained in detail the organization of the club and outlined the duties of each officer and committee. He spoke of the meetings that have been held and cited the benefits derived from these meetings at which a prominent speaker is generally heard. The financial end of the question was also discussed and the Cleveland League will undoubtedly derive much benefit from Mr. Vose's remarks.

Infringement on Paint Patents.

In a recent suit which the Standard Paint Company brought against a certain company for infringement of patents, the judge found for the complainants. The decision handed down by Judge D. W. Ray was that the first successful colored roofing upon the market was the colored ruberoid made in accordance with the claims of the patents in suit. He held further that the defendants had infringed on the patents of the Standard Paint Company.

Letters by Wire.

It has been announced by the management of the Western Union Telegraph Company, that plans are being made to inaugurate a new form of service called the "Night letter service." When this rate goes into effect night messages may be sent at one-fifth of the day rate.

Prof. Elihu Thomson.

Prof. Elihu Thomson was the guest of honor at the annual dinner of the American Institute of Electrical Engineers on Thursday evening, February 24th. On this occasion the first Edison gold medal was officially awarded to him for meritorious achievements in electrical science, engineering and arts, as exemplified in his contributions thereto during the past thirty years.

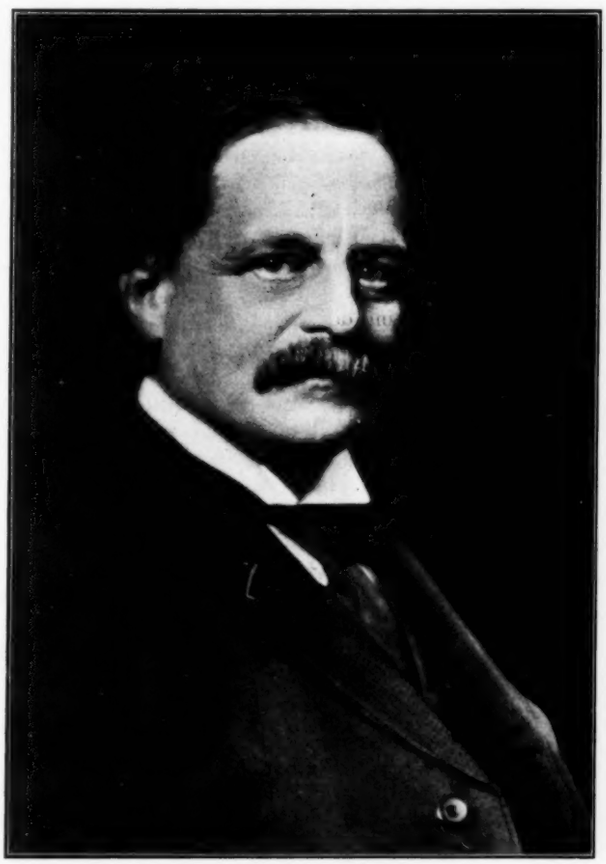
Professor Thomson was born at Manchester, England, March 29, 1853. In 1858 he came to the United States and received his early education in the public schools of Philadelphia, from the Central High School of which he was graduated in 1870. Later he joined the faculty of this same institution and was first made assistant professor of physics and chemistry, and a few years later full professor on these subjects.

During these years Professor Thomson had his inclinations turned towards experiments in electricity and spent much of his time in making apparatus for carrying out numerous researches. In the latter seventies he had developed and was granted a number of patents on his arc lighting system. Turning his attention more and more to this work, Professor Thomson left his professorship in 1880 to devote himself entirely to his electrical interests. With him was associated Prof. Edward J. Houston. A company was organized and known at first as the American Electric Company, which in 1880 became the Thomson-Houston Company. Of this corporation Professor Thomson became the expert electrician.

The perfection of his famous arc lighting dynamo and arc lamp went on quite rapidly and they were installed in a great many of the early lighting plants, both in this country and in Europe. His generator was one of the first and one of the most efficient and ingenious ones that were used in the early development of arc lighting.

Professor Thomson directed his attention to other electrical machinery and appliances, one of his early inventions being that of the well known recording watt-hour meter. A number of indicating instruments were also devised to suit the circuits that were in use.

The company with which Professor Thomson was so prominently associated soon gathered other great leaders to it and in 1892 by consolidation with the Edison interests became the present General Electric Company. Professor Thomson's headquarters are at the Lynn works in Lynn, Mass., near which, at Swampscott, he has his residence. He is still actively engaged in his electrical investigations, and as a result of these has been granted over 600 patents on his various inventions. One of the lines in which he has particularly interested himself is that of electric welding, which he has brought to a high state of commercial development.



PROF. ELIHU THOMSON,
Who was Awarded the Edison Medal at the Annual Dinner of the American Institute of Electrical Engineers.

Professor Thomson's researches and inventions have brought him not only international renown but numerous awards and prizes. He was president of the American Institute of Electrical Engineers in 1889-90. At the Paris Exposition in 1889 he was awarded a Grand Prix and in the same year he was decorated by the French government as an Officer and Chevalier of the Legion of Honor. In the meter contest in Paris in 1890 he won a joint award for his watt-hour meter. In 1893 he was the official United States delegate at the International Electrical Congress in Chicago. At the Paris Exhibition in 1900 he was again awarded the Grand Prix for the exhibition of his numerous inventions. In 1904 he was president of the International Electrical Congress at St. Louis. He also won the Grand Prize at this exhibition. He was awarded the Rumford medal in 1902 and has been the recipient of a large number of other awards and honors for his researches and inventions.

Professor Thomson is a member of numerous engineering and scientific societies. The Institution of Electrical Engineers, of Great Britain, elected him to honorary membership. Notwithstanding his great prominence in the electrical and scientific field, and the numerous medals and awards of which he has been recipient, Professor Thomson is personally most democratic and sociable in his disposition. He has a simplicity of manner which puts any one immediately at ease who consults him on any conceivable topic.

The Philadelphia Strike.

Philadelphia, Pa., is again the scene of a strike of the employes of the Philadelphia Rapid Transit Company which is causing loss of life, damage to property and otherwise subjecting the public to inconvenience and cause for alarm.

A general strike of all sympathizing unions is threatened but it is hoped that this may be averted by a speedy settlement between the employes and the traction company which will result in the prevention of future demonstrations of a similar character, in which the hoodlum element of the city takes such a riotous and lawless part.

Chicago Electric Club.

In a thorough and comprehensive maner, Bion J. Arnold, chairman and chief engineer of the Board of Supervising Engineers, Chicago Traction, explained what has been accomplished in the rehabilitation work of the Chicago traction companies at the meeting of the Electric Club in the Green Room of the Kuntz-Remmler restaurant on Wednesday, February 16.

Mr. Arnold first explained the ordinances passed on February 11, 1907, known as the "Settlement Ordinances," and which were later submitted to a referendum vote of the people. These ordinances authorized the Chicago City Railway Company and the Chicago Railways Company to reconstruct all of the old cable and electric lines, establish an elaborate system of through routes, and created the Board of Supervising Engineers whose duty it is to pass judgment on all problems relating to the engineering work of the railways.

This board consists of a representative of each road, a representative of the city, and a chairman who is neutral. The votes of the traction representative are divided so as to balance with the vote of the city, and in case of a tie the chairman is to cast the deciding vote.

Under these ordinances the city reserves the right to purchase the railway properties for a sum equal to the physical valuation placed upon them, to which is added the actual money expended by the companies for addition to the property, together with an allowance of ten per cent as a construction profit and five per cent for brokerage upon all such expenditures.

Regarding the city's share of the traction earnings, the ordinances specify that all operating expenses should be paid out of the gross receipts and the companies shall then reserve an amount equivalent to five per cent upon the capital investment, as an annual interest charge. The balance is known as the net profit, and of this amount the city is entitled to fifty-five per cent and the traction companies to forty-five per cent. During the three years in which this system has been in effect the companies have put $3,000,000 into the city treasury, and this amount will be increased by $1,500,000 before the end of the summer.

Referring to the actual work which has been accomplished, Mr. Arnold said that a total of 305 miles of lines have been reconstructed. In this work there have been used 465 miles of electric cable, 7,000,000 pounds of copper wire, and enough brick to form a wall twelve feet high, thirteen inches thick, and eighteen miles long. There has also been 900,000 feet of conduit and 5,500,000 feet of duct laid and 2,400 manholes constructed.

The track construction has been along the most approved lines, and the speaker claimed that with the new types of cars and when the through routing system had been completed, Chicago would have one of the finest traction systems in the world.

There have been three types of track construction used in this rehabilitation work, seventy-five per cent of the 305 miles of track being laid on treated ties on a concrete roadbed. There are also a number of miles of track laid on a concrete roadbed with steel tie construction. In the downtown district, however, the track construction is treated ties on a crushed stone roadbed, this construction being deemed advisable on account of the future construction of the subway, which would otherwise necessitate tearing up of all the downtown tracks.

Further statistics given by Mr. Arnold showed that there had been seven complete substations constructed and one storage battery plant. Also, 78,400-kilowatts capacity of rotary converters, and 422 kilowatts of storage batteries installed.

There have been 1,352 "pay-as-you-enter" cars purchased, and 826 old double-track cars have been remodeled along these lines, making a total of 2,178 practically new cars. Mr. Arnold also spoke of the fenders which had been adopted, and although only in use a short time they have saved four lives.

The total work of rehabilitation has cost $36,955,858, and the properties are now worth approximately $95,000,000. Mr. Arnold stated that the $100,000,000 mark would be reached before the end of the summer, as against a $50,000,000 valuation at the time the ordinances were passed.

Regarding the river tunnel proposition, the speaker predicted that the Van Buren Street tunnel would be finished in about three months. The one at La Salle Street in another year, and the Washington Street tunnel by the end of 1910. These tunnels and portions of the elevated structures have been the only drawbacks to the completion of the through routing system, but this, however, will shortly be overcome.

President Vose announced that Frank L. Perry had been appointed chairman of the entertainment committee, the duties of which are to greet the members and guests as they enter the meeting room and make them acquainted with each other.

This move is to be highly commended as the object of the Electric Club is primarily, good fellowship and the establishment of a cordial feeling between all members. In the capacity of chairman of the reception committee Mr. Perry will have an opportunity of exercising his excellent qualifications along this line, for the general betterment of the club.

Chicago Section, Illuminating Engineering Society.

The February meeting of the Chicago Section of the Illuminating Engineering Society was held on Friday noon, February 18, in the Chicago room of the Great Northern Hotel. Shortly after luncheon, Preston S. Millar, general secretary of the Society, was introduced by Chairman Scheible as the speaker of the day. Mr. Millar immediately launched into his subject, which was "Recent Developments in Illuminants." This he illustrated with numerous lantern slides and exhibits of lamps.

The last three decades have witnessed great development in all classes of illuminants. After a general survey of this development Mr.Millar took up in detail the most important types of lamps. The kerosene lamp has been adapted for use with mantles, which increases the efficiency three or four times while new, and gives about 500 candle-hours per gallon of oil. Kerosene lamps are also used under pressure with a fair degree of success. For some years the alcohol mantle lamp has been upon the market and has given a fair measure of satisfaction when properly attended to. It produces about 1,500 candle-hours per gallon of alcohol.

Acetylene lamps have become quite common and for one-foot burners yield thirty-five candlepower per cubic foot of gas. Acetylene is used either direct from a generator or from tanks in which it is absorbed in acetone under pressure. It has been very extensively employed for automobile lighting and to a certain extent also in train lighting. Isolated country houses also make use of it in some instances.

As regards illuminating gas there has been considerable advance in some lines recently. The mantle burners, however, have not been improved upon a great deal to increase their efficiency. The upright mantle burner gives about fifteen candlepower to a cubic foot of gas. The inverted mantle is much more rugged than the former and gives, of course, a much better downward distribution, although its mean spherical candlepower efficiency is not very much higher.

The numerous gas "ares" that were becoming so common in the last few years, are being rapidly replaced by inverted mantle burners, frequently of the multiple kind. Recently the manufacturers of gas lighting appliances have directed their attention to making these devices more convenient, as by auto-ignition, and they have also increased the variety and sizes of these appliances. In the line of self-lighting lamps there is now a large variety, some providing a small pilot light and by-pass, some depending upon electric ignition, and some depending upon the property of platinum black to ignite hydrogen-containing gases.

There has been some development in gas signs. Mr. Millar stated that at the recent gas show in New York city there was a sign in front of Madison Square Garden which flashed the letters one after another and then all simultaneously, much as an electric sign does. In all these recent developments there is evidence that the gas interests have felt the competition of electric lighting and, realizing the convenience and adaptability of the latter, have tried to incorporate some of these features in gas-lighting devices. Compressed gas lamps have been used to some extent, particularly in Europe, where they are said to give very good results. With them is used a mantle made of artificial silk. These are very difficult to make in a perfect manner, but those that are turned out as perfect are remarkably fine specimens of what a gas mantle should be; they apparently improve with age.

A new type of gas lamp is known as the "self-intensifying burner." In this a small hot-air engine is used for providing additional circulation and for reconsuming the products of combustion to a certain extent.

Taking up incandescent electric lamps, Mr. Millar said that the treated carbon filament was a great advance in this direction. Within the last ten years he had found something like fifteen per cent improvement in carbon-filament lamps due to better methods of production. Tantalum lamps have been improved within the last few years and are extensively in use, more so, the speaker thought, than seems to be justified by the perfection of the more highly efficient tungsten lamps. For alternating currents the tantalum lamps do not give such a long life as with direct current.

Nernst lamps, on the other hand, said Mr. Millar, do not give quite so good a performance on a direct current nor at 110 volts as they do on alternating current circuits and 220 volts. The Nernst lamp has been greatly improved recently by simplifying its construction so that it consists of merely three parts each independently replacable. These are the body of the lamp itself, the ballast, and the glower with its heater and holder.

The tungsten lamp, he thought, it was unnecessary to dwell on at length because of the attention it has received within the last few years. Its light is affected very much less by voltage changes, particularly excess voltages, than any other type of incandescent lamp. Its candlepower also decreases less with voltage increase than does that of the carbon lamp. It is difficult to give satisfactory results of life tests, because at the time a prolonged test of this kind is completed the new lamps on the market have been so improved that the former results are no longer typical. Further improvement in this lamp is to be expected.

Taking up the old carbon open arc lamp, it is notable that these have given better results in Europe than in this country. This is due largely because they were provided with better carbons and were usually supplied with larger current, it being very common to have fifteen-ampere series circuits. This makes the lamp very much steadier and increases its efficiency. The most recent installation on a large scale of open arc lamps is on Market Street in Philadelphia, where two lamps are placed on each post and sixteen posts are used in each block. The carbons for these lamps are of a broad rectangular section, and the lamps are provided with opal reflectors.

The inclosed carbon arc lamp attained its great vogue in this country because the cost of maintenance is considered so important here on account of relatively high labor cost. The latest form of inclosed lamp, namely, the so-called "intensified arc," is equally good on direct current or alternating current, and yields an exceptionally white light.

Flaming arc lamps, which have become so common for spectacular and advertising display, are now being introduced for regular street lighting where high intensity is desired. The ordinary yellow flame lamp makes use of calcium fluride in its electrodes. Maintenance of all flaming arcs is very high. A number of attempts have been made to reduce this charge by building magazine lamps containing in some instances as many as eleven parts of carbon, by the use of long carbons, and recently by the development of the so-called "regenerative" lamp. The latter Mr. Millar regards as quite promising. New types of flaming arcs may be expected in the not distant future.

The use of metallic arcs has become very popular for street lighting. They give a white light, are particularly suitable for series circuits, have a relatively low maintenance charge on account of the long life of the electrodes, and in the new types give a fairly steady light. A new type of this lamp about to be put on the market does not require cleaning of the globe between trims.

Mr. Millar thinks that the arc lamps that are to be used extensively in the future will be of the two general types, the intensive carbon arc for interior use, and the flame arcs both with impregnated and metallic electrodes for outside use. In this connection also he showed how a 6.6-ampere direct-current series circuit is exceptionally adapted to carry tungsten, inclosed arc, magnetite, and flaming arc lamps all in series on the same circuit, thus making it the most flexible type of series electric lighting circuit.

In the line of vapor-tube lighting there has been not such radical advance. The Moore tube is produced in two forms, of which one using carbon dioxide vapor gives what is said to be a pure white light. The mercury-arc lamp has received improvements in mechanical and electrical details of construction, and still remains the most efficient electric light source. The modification of this lamp using a quartz tube gives a very large percentage of ultra-violet rays, and is therefore used to a certain extent in medical work. It is extremely dangerous, however, as exposure to it results in serious skin maladies. It must therefore be used only by an expert.

In conclusion, Mr. Millar declared

emphatically that we cannot have too many types of illuminants, as we need a great variety of them having different qualities and characteristics. Nearly each type that he referred to fills a want in a special field. The illuminant which is condemned for one class of service is likely to give good results under other conditions that are more favorable to it. Therefore he thought there was abundant room for all kinds of lighting, and we should be thankful that we have such a variety to select from.

New York Section, Illuminating Engineering Society.

The regular February meeting of the New York Section of the Illuminating Engineering Society was held in the Engineering Societies Building, New York city, on the evening of February 17. A paper by George W. Knight and A. J. Marshall on "Public School Room Lighting" was read by the former before a rather small gathering, due in part to the inclement weather. Mr. Knight's paper covered some eleven tests which were made with various types of lamps and reflectors in school class room at Newark, N. J. It was found that the average intensity required to give satisfaction should be at least three foot-candles.

The discussion was opened by Mr. Hatch, of Boston, whose work for the Boston School Board has received such favorable comment. He stated that from the results of the experiments which have been conducted during a period of over two years, it was found that nine single units arranged to the left and forward instead of being equally spaced so as to give an unilateral distribution had been found to be the most successful. He stated that the nearer we approach daylight conditions the better the results, and that it was more important to have the light coming obliquely over the left shoulder than it was to have an equal intensity on each of the various desks throughout the room.

Mr. Thomas, of the Board of Education of New York city, stated that it had adopted nine 100-watt Gem lamps with Opalux reflectors located forward in the left side of the room as in Boston. He also stated that the intensity obtained ranged from 3.1 to 3.4 foot-candles.

Mr. Jones criticised the Newark installation on account of the attempt to obtain uniform instead of unilateral distribution. The discussion was not confined to school-room lighting, but included that of libraries, reading rooms, etc. Much that was valuable and interesting was brought out, especially regarding the physiological aspects of the situation.

The announcement of the March 10th meeting includes a paper on "The Relationship Between Decorations and Fixtures," by C. R. Clifford, and three papers on "Color Values," by Dr. H. E. Ives, D. M. Moore, and W. D'A. Ryan.

Engineers' Society of Western Pennsylvania.

The regular monthly meeting of the Engineers' Society of Western Pennsylvania was held in the society rooms, Fulton Building, Pittsburg on February 15. Elmer K. Hiles was re-elected secretary for the ensuing year.

A paper on "The Government Testing Station in Pittsburg," was presented by J. C. Roberts, assistant chief engineer Techmologic Branch, United States Geological Survey. Lantern slides were shown illustrating apparatus in use at the station, and a very illuminating description of the work accomplished as well as that to be taken up in connection with the testing of structural materials, fuels, and the causes and prevention of mine accidents was given.

Up to the present time the work with structural materials has been confined to reinforced concrete and the constituent material of concrete and to the testing of various clay products. During 1910 it is expected that a 10,000,000-pound testing machine will be installed, capable of testing sixty-five-foot full size section columns, etc.

In the fuel investigations most of the coals from the various districts have been tested under boilers and in gas producers, and various liquid fuels have been investigated. Much work has been done with briquetting coals. Investigations have been made along the line of the waste of coal, the conservative estimate being made that 200,000,000 tons of coal are wasted annually by being thrown on the culm banks, or left in the mines in pillars and otherwise. The gas producer investigations have demonstrated that highly efficient results can be obtained with roof coal, bone coal, etc., that is usually wasted. When firing the producer with washer refuse, carrying sixty-eight per cent ash, full load has been carried on the gas engine.

Much work has been accomplished in connection with the investigations of the causes and prevention of mine accidents. The loss of 3,000 to 4,000 lives yearly in the United States indicates the importance of this work. Various explosives have been tested and the station has established a list of "permissible explosives" for use in coal mines. Safety lamps are tested under every possible circumstance of use as well as the various types of rescue apparatus. In the rescue and training stations now in operation at Pittsburg, Urbana, Ill., Knoxville, Tenn., McAllister, Okla., and Seattle, Wash., training classes are established to educate the miners in the use of rescue apparatus and the operators are urged to send picked men to attend these classes and to establish local rescue stations in the vicinity of their mines.

An inspection trip has been arranged for Saturday, February 26, when the members of the society will visit the testing station in Pittsburg. Tests of explosives fired into 120 pounds of coal dust will be made in the gas and dust gallery, also disruptive tests will be made with the ballistic pendulum. Safety lamp tests and a practical demonstration of rescue work as carried out in mines will be made. Tests of fire brick will be made under load conditions at temperatures of 2,400 degrees Fahrenheit. The various clay-testing machines will also be in operation.

The South African Institute of Electrical Engineers.

The first meeting of the South African Institute of Electrical Engineers marked the beginning of a new era in the electrical affairs of South Africa, and showed that that country desires to go hand-in-hand with the older or longer established communities. This meeting was held at the Transvaal University College at Johannesburg with J. R. Bradley presiding.

Although the South African Association of Engineers strongly urged the alliance of the electrical body with their previously established society, this was decided against so that the two societies are entirely independent. This was mentioned in the report of the provisional committee.

The body adopted a constitution which was virtually as had been drafted by the Provisional Committee. At the election of officers the following were chosen: C. W. R. Campbell, president; W. Elsdon-Dew and M. Rohmann, vice-presidents, and Fred Rowland, secretary.

Commission News from New York.

The Public Service Commission, Secon District, has received a petition from the Palmyra Gas and Electric Company, Newark Gas Light and Fuel Company, New Light, Heat and Power Company of Newark, Lyons Gas Light Company and Wayne County Electric Company, for the approval of the consolidation of these companies into the Wayne County Gas and Electric Company, and to make a mortgage covering all the properties of the consolidated companies and to issue bonds thereunder. The names of the towns in which the operations of the new corporation are to be carried on are Palmyra, Arcadia, Lyons and Galen, all in the county of Wayne. The capital stock of the new corporation is to be $200,000. Authorization is asked for the execution of a mortgage to the amount of $750,000 and to issue bonds to the amount of $500,000. The reason given for the consolidation is that it is greatly to the advantage of the petitioning companies and to the properties, as well as to the people living in the villages and towns served by the corporations. The plan of consolidation provides for the reduction of the capital stock of the company below that of the combined stock of existing companies by $45,000. One of the results of the consolidation claimed by the petitioners is that it will reduce the cost of operation, reduce the cost of executive force of the five companies coming into consolidation, reduce the cost of bookkeeping and accounting necessary for five plants, simplify the entire operation and doubtless reduce the cost of supplies inasmuch as the consolidated company can purchase for the five plants. It is also expected that a better market for the securities can be obtained under the consolidated company than by the separate properties.

The commission has authorized the Empire Electric Company of Franklinville, Cattaraugus County, to issue its common capital stock to the amount of $21,800 to pay certain indebtedness of the company and provide working capital.

Two bills have been introduced in the legislature of New York amending the Public Service Commission law. One, presented by Assemblyman Goldberg, gives the Public Service Commissions power to order the issuance of transfers on street railroads, and to prescribe the distance that passengers may be transported on transfers, the number of successive transfers to be issued for a single fare and the time after its issue in which a transfer may be presented.

The second bill, introduced by Senator Griffith, amends the Public Service Commissions Law to require decisions on applications for common carrier franchises within sixty days of their submission.

Assemblyman McGregor has presented a bill amending the general city law by inserting a new article relating to master electricians. The bill provides for the registration of master electrician by a State Board of Examiners of Master Electricians to be appointed by the Governor. One member of the state board is to be a representative of the Underwriters' Association of New York city, one a representative of the journeyman electricians of not less than seven years' actual experience, one an electrical engineer of not less than seven years' actual experience, and two are to be employing or master electricians of not less than seven years' actual practical experience in the business of installing electrical apparatus. The state board is to establish city boards of examiners. There are nmerous provisions regarding the powers and duties of the boards and violations of the provisions of the bill.

Chicago Elevated Loop Situation.

The local transportation committee of the Chicago City Council took up with representatives of the several elevated roads in Chicago recently the question of congestion on the Union Elevated Loop, which encircles the central part of the business district of the city. The chairman of the local transportation committee declared that an effort would be made to bring about such a solution of the problem as would increase the capacity of the loop tracks. In his opinion, the best means to do this was by through routing of the trains of the four elevated railroads.

As a result of this meeting it was decided to appoint a committee consisting of the president and chief engineer of each elevated railway for the traction interests and Bion J. Arnold as a representative of the city to solve this problem of congestion. Accordingly plans for through routes, universal transfers, platform extension, and other methods of alleviating the loop congestion are being considered, and Mr. Arnold declares that the necessary reforms can be made within a month. The working out of a final comprehensive plan is now only a question of agreement and harmonizing of the various plans proposed by the city and each of four railroads.

Indeterminate Franchise Law Decision.

The case of the Kenosha Electric Railway Company attacking the constitutionality of the indeterminate franchise law has been decided against the company at Racine by Judge Belden. The suit resulted from the action of the Kenosha Gas and Electric Company of taking an indeterminate franchise in place of its original one, which action shut out the Kenosha Electric Railway Company, holding a contract for lighting the city of Kenosha. The latter company brought suit on the ground that the franchise law was unconstitutional in that both legislative and judicial powers to the railroad commission and that the company had been granted a franchise by the Kenosha city council before the passage of the franchise law. It was held by Judge Belden that the law in terms was absolute and no other franchise could be held after the Kenosha Gas and Electric Company had given up its original franchise for an indeterminate franchise.

Additions to New York Wiring Rules.

Commissioner Henry S. Thompson, of the Department of Water Supply, Gas and Electricity, New York city, has announced the following changes in the electrical rules and regulations in force in New York:

A third paragraph has been added to Rule 4 b, to read as follows:

> Under special authorization in writing, given in advance, incandescent lamps may be used for the purpose of resistances in series with other devices when mounted in porcelain receptacles upon non-combustible supports and so arranged that they cannot have impressed upon them a voltage greater than that for which they are rated.

A further amendment has been made to Rule 31-A, by adding to the general note the following sentence:

> The term "theatre" shall mean also any moving-picture machine establishment whether provided with a stage, or not.

The rule numbers refer to the National Electrical Code, which was recently adopted with slight changes as the official code of rules of the New York bureau of electrical inspection. The changes take effect immediately.

Philadelphia Electrical Show.

The closing on February 26 of the first electrical exhibition which has been held in Philadelphia for a period of twelve years, marks a new era in the electrical industry in that city, and the large attendance and the interest manifested indicates that a similar exhibition will be held annually hereafter.

NIGHT VIEW OF BROAD STREET, LOOKING TOWARDS ARMORY.

CITY HALL'S WELCOME TO SHOW.

The show was instructive, interesting and amusing, aside from being probably a financial sucess to both exhibitors and the show company. Local and national electrical manufacturing companies were well represented by the various electrical devices which conveyed to the crowds which thronged the Armory an adequate idea of the strides that are being daily made in the application of electricity.

The exhibits of the City of Philadelphia and the University of Pennsylvania gave a historical touch to the occasion, the latter showing a number of the first types of telephone transmitters, the early Edison platinum incandescent lamp made in 1878, an autotograph of the great Faraday, relics and experimental devices used by Benjamin Franklin, and other material bearing upon the early experiments in electricity.

Wireless telegraphy and telephony played an important part in the show, the former being the agency employed to transmit the opening message from the mayor to the show officials. Visitors were also given a more spectacular demonstration along these lines by hearing the voices of grand opera singers transmitted to the Armory from a theater some distance away and intensified by means of other apparatus.

An amusing and interesting feature of the show was the nightly demonstration by Earle L. Ovington of the harmless character of a certain vibratory current. He permitted hundreds of thousands of volts to pass through his body, lighting cigars at the tips of his fingers with the sparks, and performing other strange feats.

On Friday evening, February 18, the Sons of Jove held a rejuvenation, at which a large number of new members were initiated, following which an elaborate and successful banquet was held.

It was unfortunate that during the last week of the show the strike of the street railway employes occurred, as this materially affected the attendance and dampened the ardor manifested previously.

Following is a list of exhibitors with a description of their exhibit:

The Auxiliary Fire Alarm Company, of New York, exhibited its Gamewell fire-alarm telegraph system, adopted for use in cities, and also smaller sets applicable for industrial plants and buildings. A. L. Bunting and N. MacDougal were in attendance.

S. R. Bailey & Company, Amesbury, Mass.,

GENERAL VIEW OF INTERIOR OF ARMORY.

exhibited an electric victoria phaeton equipped with the new Edison battery. In attendance were Col. E. W. Bailey and Philip E. Whiting.

James Barker, Inc., Philadelphia, Pa., showed a line of electric vibrators, hair driers and electric barber-shop appliances. The exhibit was in charge of W. P. Gerner.

J. C. Bartlett, Philadelphia, Pa., had on exhibition a "Woods" electric victoria, a

product of the Woods Motor Vehicle Company, Chicago, Ill.

J. E. Caldwell & Company, Philadelphia, Pa., had an attractive display of portable lamps, silver candelabra, silver pocket lamps and silver coffee percolators. A feature of the exhibit was the demonstration of its electric silver-polishing machines. W. Ennis, F. J. Lynch and R. C. Putman were in attendance.

H. B. Camp Company, New York, N. Y., through its Philadelphia office, made an attractive display of its various forms of clay and vitrified ducts used in underground conduit work. E. Nickson was in attendance.

City of Philadelphia, Electrical Bureau, maintained an exhibit that attracted much general attention. The public was given the opportunity of seeing in actual operation the fire-alarm and police signalling systems actually used in Philadelphia. There was also shown the bureau's types of universal patrol boxes, combination fire and high-pressure signal boxes, electric police registers, etc. The exhibit was designed by Chief McLaughlin of the Bureau.

Collins Wireless Telephone Company, Newark, N. J., exhibited, in operation, a wireless telephone system and also the Collins-Sanchez high-frequency apparatus. E. L. Pine, William Debilier and A. F. Collins were in attendance.

Commercial Truck Company of America, Philadelphia, Pa., had on exhibition two of its commercial vehicles.

Duntly Manufacturing Company, Chicago, Ill., occupied an attractive booth wherein a number of its vacuum cleaners for commercial and domestic use were shown in operation. C. R. Ely of the Philadelphia office was in charge.

Diehl Manufacturing Company, Elizabethport, N. J., had on exhibition a complete line of its motors, for both alternating and direct-current circuits. Included in the exhibit were direct-connected and belted units, fans, individual sewing-machine motors, electric coffee grinders, buffers and other miscellaneous electrical equipment. W. I. Cheyney, manager, Philadelphia office, was in charge.

Electrical Contractors' Association, Philadelphia, Pa., which is composed of the electrical contractors of Philadelphia, exhibited a miscellaneous assortment of apparatus and devices used in electrical construction. Among the material and apparatus shown was National metal molding, Patrick, Carter & Wilkins' annunciators, Connecticut Telephone Manufacturing Company's telephones, Heaney tungsten lamps, Sprague Electric Company's conduits, fittings and fans and Holtzer-Cabot motors, magnetos, etc. There was also shown a sectional view of part of a house showing the methods of installing wiring.

Electrical Review and Western Electrician, Chicago, Ill., occupied a booth prominently located near the main entrance, where friends and visitors were welcomed.

Electric Storage Battery Company, Philadelphia, Pa., had on exhibit a complete line of its Exide batteries for lighting and ignition purposes, particularly adapted for electric vehicle use. There was also exhibited a complete "Hyray" lighting outfit for automobiles and a mercury-rectifier charging outfit. A feature of the exhibit was a standard 4,000-ampere Exide cell. Detailed parts of the jars, plates, etc., of Exide batteries were also shown. J. S. Reynolds was in charge of the booth, assisted by Messrs Elberson, Kalas, Hunt and Conard.

Engineering Equipment Company, Philadelphia, Pa., exhibited a line of electrical protective devices manufactured by the Condit Electrical Manufacturing Company, Boston, Mass. The display included air-break circuit-breakers, oil circuit-breakers, with no-voltage release, and automatic oil switches for currents as high as 15,000 amperes. A feature of the exhibit is a remote-control 15,000-ampere oil switch. Jos. P. Manypenny and Geo. P. Wilson, of the Engineering Equipment Company, and Geo. Burnham and F. Masterson, of the Condit Electrical Manufacturing Company, were in attendance.

The Federal Electrical Company, Chicago, Ill., exhibited a complete line of electric signs, which included sectional letter signs, flasher signs, lamp clusters, "Adlite" window displays, tungsten clusters, etc. J. J. Magee, H. I. Markham and A. R. Deane were in attendance.

Fort Wayne Electric Works, Fort Wayne, Ind., through its Philadelphia branch, exhibited a line of motors, meters, transformers for both bell-ringing and lighting circuits, and compensarc and balancarc used for stereopticon lamps. This company maintained a prominently located booth and had in attendance A. H. Boyd, manager, Philadelphia office, J. B. Coghill and H. G. Fetherling.

The General Electric Company's exhibit included an up-to-date line of heating devices, mazda and tantalum lamps, flaming arc lamps, intensified-arc lamps, magnitite, or luminous lamps, cabinet panels, fuses, motors, and bell-ringing transformers. In the heating department were chafing dishes, percolators, water cups, stoves, toasters, milk warmers, irons of all types and a complete kitchen outfit. The lamp department exhibited a complete line of mazda and tantalum lamps for 100-volt and 220-volt service for every possible demand. Two cabinets lighted by a series of tiny mazda lamps showed miniature lamps of all sizes. By means of a photometic and two revolving wattmeters there was shown the tremendous advantage of the mazda lamps over the carbon lamp. A model automobile dash board upon which were mounted mazda head, side and tail lights demonstrating the simplicity and efficiency of this modern method of lighting automobiles. By means of wattmeters the contrast in efficiency of the mazda and carbon sign lamps was shown. In the arc lamp department was shown lamps for store, office, street and factory lighting. The motor department includes a line of power motors, fan motors, buffing motors, etc. Among the representatives of the company present were Messrs. Mullin, Bailey, Thompson, Gale, O'Brien, Ramond, Rue, Sturgeon and Tattersfield. The exhibit was installed by L. W. Shugg, of Schenectady.

General Vehicle Company, Long Island City, N. Y., exhibited a three and one-half-ton commercial truck, together with a mercury arc rectifier connected to the batteries on the vehicle, thus showing the method of charging from an alternating-current circuit. The truck shown was mounted on a stand so as to allow the vehicle to be shown in operation. W. Wesley White was in charge of the exhibit.

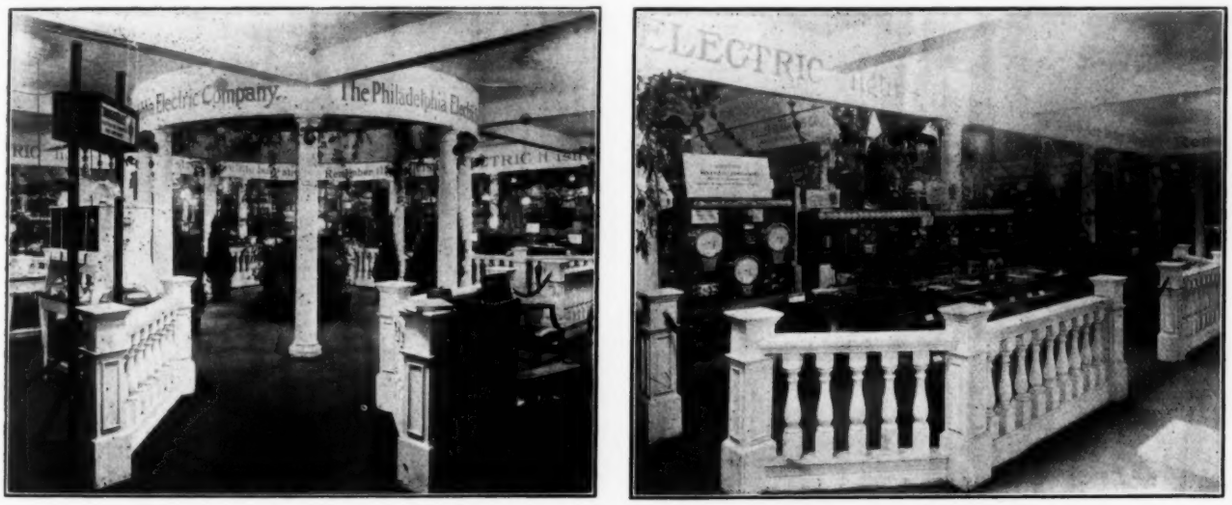
Helios Manufacturing Company, Philadelphia, Pa., exhibited its economic lighting system in operation as well as the Helios battery for vehicle and ignition work. Helios flaming arc and inclosed arc lamps were also shown. C. P. Mac Gonigal and G. H. Rettew were in attendance.

Hurley Machine Company, Chicago, Ill., showed in operation its Thor electric washing and wringing machine. N. Herbert Haberle, of the New York office, was in attendance.

International Correspondence Schools, Scranton, Pa., showed a large assortment of its electrical and technical books and distributed literature pertaining to its various engineering courses.

Invincible Renovator Manufacturing Company, Pittsburg, Pa., exhibited through the Invincible Renovator Sales Company its portable vacuum cleaners for domestic and commercial uses. Q. P. Stahlman, D. L. Smeltzer and F. W. Saddler were in attendance.

H. W. Johns-Manville Company, New York, N. Y., showed a line of "Linolite" desk and table lamps, "Noark" inclosed-fuse devices,



TWO VIEWS OF THE PHILADELPHIA ELECTRIC COMPANY'S LARGE EXHIBIT.

asbestos and magnesia steam pipe and boiler coverings, transite asbestos lumber, vitribestos, J-M sectional conduit, and electric railway supplies. The company was represented by D. T. Dickson, H. M. Voorhis, D. K. Dickson, L. R. Yeager, H. Mulry, W. G. Benner, J. W. Day and E. W. Drew.

Keller Manufacturing Company, Philadelphia, Pa., exhibited jointly with the Keller-McManus Company, the well-known Santo portable vacuum cleaners. These were shown in operation and the mechanism displayed in glass cases. H. Keller, C. H. Spotts, and C. J. McManus were in attendance.

Keystone Telephone Company, Philadelphia, Pa., had installed a full telephone switchboard equipment which gave service over its entire system to each exhibitor.

Metropolitan Engineering Company, Brooklyn, N. Y., showed its electric sign letters, and various protective devices and porcelain specialties of its manufacture.

Edward Miller & Company, Meriden, Conn., exhibited an attractive line of portable electric lamps and art-glass shades.

some idea of the methods used in transmitting the electricity from its generating station to them. The working of meters was demonstrated and explained in detail by a staff from the company's office in another section of the booth. The relative color properties of the various types of lamps on the market were shown in connection with vari-colored goods in adjacent compartments, and in the center of the space was a large revolving stand containing interesting pictures of the company's generating system, substations and various examples of motor-driven refrigerating machinery, motor-driven industrial plants, church, store and private-house illumination, etc.

Philadelphia Rapid Transit Company showed a miniature elevated railroad structure, with a car in operation. The model was on a scale of one foot to twenty. A semaphore signal such as is used on the Market Street Elevated Railway was shown and also the new motor car emergency wagon. This exhibit, which attracted much attention, was in charge of James Heywood.

fan which can be bracketed by thumb screw adjustment without means of any extra parts or tools. E. B. Day, manager of the Philadelphia district, and G. Pechin were present at the booth.

Simplex Electric Heating Company, Cambridge, Mass., showed a complete line of electric heating devices for the home, which included its new breakfast room toaster and combination griddle for hotels and restaurants. There was also shown the company's laundry type iron with automatic standard suspension arm with pilot lamp which makes a most complete and satisfactory outfit for factory installation. The restaurant at the show used Simplex apparatus consisting of New No. 9 range, coffee urns, frying kettles, combination toaster and griddle and waffle irons. E. B. Stebbins, Philadelphia representative, was in charge, assisted by L. L. Warfield and H. B. Atkin.

Studebaker Brothers had on exhibition an electric victoria and a coupe. G. D. Woodworth represented the company.

Simplex Engineering Company, Philadelphia, Pa., showed its Quartzalite electric

VIEW OF WESTINGHOUSE EXHIBIT.

VIEW OF GENERAL ELECTRIC EXHIBIT.

N. A. Dutton, B. H. Dutton, and H. L. Dyson were in attendance.

National Dictograph Company, New York, N. Y., exhibited jointly with the General Accousticon Company, the Dictograph and the Accousticon, sound magnifying devices.

Nernst Lamp Company, Pittsburg, Pa., exhibited its various types of Westinghouse-Nernst multiple, single-glower, cluster and bowl type lamps. S. Stevenson and H. N. St. Clair, of the Philadelphia office, were in attendance.

New Holland Machine Company, Oaklyn, N. J., exhibited a line of its gas engines and vacuum cleaners.

Nohe Electric Renovator Company, Chicago, Ill., exhibited its electric cleaning outfits. I. A. Nohe was in charge.

Otis Elevator Company, New York, N. Y., in a specially constructed tower about thirty feet high, exhibited a working model of an Otis automatic push-button elevator. Those in attendance were E. F. Morse, W. McD. Manning, E. W. Deakin, H. P. Bates, G. F. Miller and W. C. Doan, all of Philadelphia, and M. C. Baldwin, of New York.

J. C. Parker & Sons Company, Philadelphia, Pa., exhibited a Detroit electric roadster, manufactured by the Anderson Carriage Company, Detroit, Mich.

Philadelphia Electric Company exhibited a section of manhole to illustrate its underground distribution system; a pole line and transformer to illustrate its overhead distribution; a complete service connection with meters, etc., so as to give its patrons

H. T. Paiste Company, Philadelphia, Pa., had on display a complete line of electric light specialties and wiring devices. The company's pipe taplets for rigid conduit work, outlet boxes, sectional panel boxes, molding taplets, iron boxes, and various specialties were exhibited. By means of twenty-one fittings and standard goods it is claimed that 1,890 different wiring devices can be made. The company manufactures about 650 different electric light specialties. W. W. Winship, W. T. Thomas, E. A. Jenkins and G. MacElwee were in attendance.

Portable Battery Fan Company, Philadelphia, Pa., exhibited its portable fan, operated by storage batteries inclosed in a jar on which the fan rests. H. H. Hirsch was in charge.

Philadelphia Electric and Manufacturing Company, Philadelphia, Pa., exhibited its tungsten arc lamps fastened to an ornamental pole. A novel feature of this exhibit was a 450-watt tungsten lamp which was the largest incandescent lamp shown. C. L. Bundy, manager of the company, was in charge.

The Sanitaria Company, Philadelphia, Pa., exhibited a line of Shelton vibrators and hair driers. Dr. Hornells was in charge of the exhibit.

The Robbins-Myers Company, Springfield, Ohio, through its Philadelphia district office, exhibited a miscellaneous line of Standard fans and motors, the latter in sizes from one-tenth to fifteen horsepower. A special feature of this exhibit was an air oscillating

radiator. This is a device recently placed on the market which consists of six glowers or quartz tubes containing spiral coils of wires. Herbert Evans was in attendance.

B. F. Sturtevant Company, Hyde Park, Mass., through its Philadelphia office exhibited the "Vortex" vacuum cleaners and a line of Sturtevant propeller fans. A. C. Warfel was in charge.

United Wireless Telegraph Company maintained an attractive book in which the wireless telegraph system was fully explained. The company installed stations at each end of the building and transmitted messages for the visitors.

Vacuum Engineering Company, New York, N. Y., exhibited two "Rotex" stationary vacuum cleaning plants. These plants are for installation in basements of buildings with pipe lines running to each floor. William Trump, of the Philadelphia office, was in charge, with J. S. Tyrell, of New York, also in attendance.

Walker Electric Company, Philadelphia, Pa., showed a line of its switches and panels together with the I. T. E. circuit-breakers manufactured by the Cutter company. P. H. Ward, Jr., was in charge of the exhibit.

The Westinghouse Electric and Manufacturing Company showed a complete line of its products. It had in operation representative pieces of its electric cooking and heating apparatus together with its line of family irons. The company exhibited several types of motors, the same being samples of its well known type S and type R

motors for general direct-current power work and CCL and type A motors for polyphase and single-phase circuits. This company also showed for the first time one of its new MS or mill type alternating-current motors, taken apart so as to show the winding and the rigidity of the frame, brackets and bearings. Different types of control apparatus was shown for the control of the different types of motors and the different classes of service to which these motors are subjected. Among the detail pieces of apparatus was shown a very complete line of portable and switchboard instruments both indicating and undergrading types. One of its automatic type A mercury rectifiers was shown in actual operation, as well as one of its type A automatic steel mill controllers, direct connected to a motor. The Westinghouse Lamp Company showed, in connection with this exhibit, a very complete display of its different types of tungsten lamps. Among those in attendance from the Philadelphia office were: John J. Gibson, manager; Thomas Cooper, manager railway and lighting department; C. V. Woodward; V. E. Cohen, manager industrial and power department; H. L. Vogel; H. M. Gansman, manager detail and supply; M. Henoch; B. Harlarr, Jr.; and W. Barnes, Jr., representing the Westinghouse Bureau of Publicity of Pittsburg in charge of the exhibit.

The Western Electric Company made a very attractive display of its line of alternating and direct-current Hawthorn motors, Sunbeam Mazda lamps, intercommunicating telephone sets, arc lamps and miscellaneous electrical goods. An attractive feature of this exhibit was an enlarged trade-mark of the company studded with incandescent lamps, showing the location of the branch offices of the company. F. D. Killion was in charge of the exhibit, assisted by Messrs. Livesey, Alexander, Hedler and Besan.

Williamson Motor Company, Philadelphia, Pa., displayed a line of Whitney instruments, Roller-Smith circuit-breakers, Swing Electric Company's motors and Bell Electric Company's motors. H. Clayton and E. Van Dyke were in attendance.

George W. Wright and W. K. Kripps exhibited their "Bull-Dog" aerial cable carriers, of which they are the inventors.

G. W. Todd & Company, Rochester, N. Y., exhibited their electrically-operated protectograph for prevention of check alternation. C. E. Wandell was in attendance.

New York Telephone Company to Train French Telephone Officials.

Monsieur Millerand, Ministere des Postes et des Telegraphes of the French Republic, has written to U. N. Bethell, vice-president of the New York Telephone Company, asking if the New York Company would be willing to take on six young telephone officials from Paris and give them a thorough practical training in all branches of the telephone business. Mr. Bethell advised the French Minister that the New York Telephone Company would be glad to aid the French telephone administration in every way by receiving and showing every courtesy to the officers who may be delegated to go to New York.

In Paris the telephone service is run by the government, and for years the telephone service of that city has been in a bady disorganized condition to say the least. Visitors to Paris claim, and even the Parisians themselves admit that the service there is execrable. Mismanagement, which frequently occurs in government-owned enterprises is said to be responsible for this bad condition of telephone affairs.

Several years ago, telephone subscribers in Paris organized themselves into an association to endeavor to secure better service. This association has a large membership and has been working to accomplish the much needed reform.

To add to the difficulties of the situation, last summer the principal telephone exchange of Paris was completely ruined by fire. At that time it will be remembered the French government turned to this country for aid, and the exchange was re-equipped with Western Electric apparatus, similar to that used in New York City.

It is stated from Paris that under the administration of the newly elected minister of posts and telegraphs, M. Millerand, the much-needed improvement of the telephone service in Paris is confidently expected. M. Millerand is taking hold of his work with unusual energy, and is endeavoring to reorganize the telephone service of Paris with the best-known telephone practice.

That M. Millerand has selected the New York Telephone Company to train his young officials is considered by telephone men a very high compliment to the New York service, although, as a matter of fact, New York's telephone service is famed all over the world for its efficiency. Also the fact that a government ownership finds it necessary to send its officials to a privately owned corporation for training is an interesting commentary on the comparative efficiency of these two types of management.

The Electrical Equipment of the Swiss Lake Valley Railroad.

The Swiss Lake Valley Railroad forms a connection between the Zurich-Berne line and central Switzerland, branching off from the former at Wildegg station and terminating at Lucerne after traversing the Lake Valley. The road serves for freight as well as passenger traffic and has been operated by steam since 1883, but was electrically equipped last year by Brown, Boveri & Company. The total length of the line is 54.4 kilometres, and it has a maximum gradient of 3.527 per cent. Single-phase alternating current at 5,000 volts and twenty-five cycles has been adopted for its operation, about 2,000 horsepower being derived from the generating station at Beznau. Transformer stations along the line are not necessary. The trolley line is a single-pole overhead conductor, and the return circuit is formed by the rails. Express, local and freight trains are operated consisting of a motor car and one or more trailers, the trains weighing from about 74 to 162 tons.

Of particular interest is the Déri single-phase series motor used on the motor cars. It is characterized by a stator fed from the line, and a rotor entirely independent of the line, having no connection whatever with the stator-circuit and provided with two sets of brushes, one fixed, and the other movable around the commutator. Torque, direction of rotation and speed of the motor are regulated by means of this movable set of brushes. The motor possesses the advantage of very simple and perfect regulation as compared with other single-phase motors, in which the variation of speed is attained by changing the tension of the supply current through a transformer. The displacement of the brushes furthermore permits continuous regulation, while ordinarily the adjustment is effected by steps. Another advantage is the simplicity of the motor itself, especially as compared with the compensated series motor, for while the latter is provided with four to five windings, the Déri motor has only two, and it can be operated directly by the high-tension current, so that even for small types a pressure of 3,000 volts may be used. The commutator of a Déri motor needs to be only half as wide as that of a series motor of equal capacity and with the same number of poles. Tests extending over a year and a half have given excellent results and the new traction motor is now to be employed in the electrification of several large trunk railways in Switzerland and Germany.—*Abstracted from Electrotechnischer Anzeiger, Berlin, January 2, 1910.*

The Franklin Institute.

At the section meeting of the Franklin Institute, Philadelphia, that was held on February 17, Carl P. Nadeod of Philadelphia, gave an address on "Electric Railway Signals" that was illustrated by lantern slides and a working model. At a meeting to be held on March 3, Arthur J. Sweet will present a paper on "An Analysis of Illumination Requirements in Street Lighting."

Joint Meeting of Engineers Discusses Industrial Power at Boston.

A joint meeting of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers was held at Boston, Mass., on the evening of February 16. The meeting assembled at the Boston Club directly after 8 p. m. at the call of Professor D. C. Jackson, chairman of the Boston Section of the American Institute of Electrical Engineers. As his paper was the first one on the programme, he turned the meeting over to J. W. Corning, vice-chairman.

Professor Jackson then presented his paper on "The Applicability of Electrical Power to Industrial Establishments." An extended abstract of this paper is given on pages 442 to 444 in the Industrial Power section of this issue.

A paper by Charles T. Main on "Central Stations Versus Isolated Plants for Textile Mills" was read by Professor Puffer in the absence of the author. An abstract of the paper follows:

In this paper Mr. Main first made a careful analysis of the costs of producing power in textile mills. He considered the generation of the power by steam engines, steam turbines and also by water power. Regarding the steam power he found that the cost varied considerably when the exhaust steam could be utilized in the mill. The greater the utilization of this exhaust the less the net cost of the power. White cotton mills do not require very much steam, except for washing. Colored textile mills, however, require a large amount of hot water for the dyeing processes. Where steam turbines are used the cost per unit of power is somewhat less than that with engines. The author also considers the cost of power production in central stations. He advocates very strongly the use of the by-products of a steam plant, used either as exhaust steam or as steam taken from the intermediate receiver, for use in the manufacturing processes. This service the public central station cannot provide because it usually supplies the power over transmission lines from some distance. A number of groups of mills have co-operated in the matter of power production by building a central station supplying the group. If such a station is within a reasonable distance of the mills so that the exhaust steam can be utilized, it is of more service to the mills than otherwise. However, since a large station produces its power at a greater economy than a small one the concentration of the power into one station may be sufficient to warrant the installation thereof.

Most of the northern mills have isolated plants. This is largely because they are older than those in the South, and were built previously to the time of power transmission, having, therefore, in nearly all instances their own plants. The northern mills also are more largely devoted to colored textile work. In the South, on the contrary, most of the mills are plain white mills, requiring no large amount of steam for dying and finishing, and also requiring less steam for heating the buildings. The southern mills also are relatively new. Therefore they are very largely equipped for the utilization of hydroelectric power. The advantages of the latter plan are quite numerous in that the investment for an independent power plant is saved. The space required for such a plant is also saved, and a better arrangement of buildings can frequently be made on this account. On the whole, however, a central station has difficulty in contracting with large textile mills for power except under the most advantageous conditions for the central station, and the most disadvantageous conditions for the textile mill.

R. S. Hale then read a paper on "The Supply of Electrical Power for Industrial Establishments from Central Stations." This paper is given at some length on pages 435-436 in the Central Station Practice of this issue.

G. H. Stickney next presented his paper on "Illumination for Industrial Plants," a long abstract of which is given in the Electric Lighting and Illuminating Engineering section, pages 438-440.

The last of the five papers presented was that by Walter B. Nye on "The Requirements for an Induction Motor from the User's Point of View." As Mr. Nye could not be present, this paper was read by Mr. Neall. An abstract of it follows:

My experience with induction motors has been mainly in sizes ranging from fifty to 500 horsepower, running twenty-four hours a day six days a week, and the prime requisite from a manufacturer's point of view is continuity of operation. I will not say that to this everything else must be subordinated, but in any industrial plant continuous operation must be maintained. To insure this the motor must be of a rugged mechanical design, with ample bearings; capable of withstanding reasonable overloads for a considerable period without undue heating; must be accessible so that it can be easily cleaned, and, in case of trouble, be easily and quickly repaired; and the motor must be able to hang on and not "pull out," even under great variations in voltage. Efficiency, power factor, and starting torque are all worthy of consideration, but are not, to my mind, as important as the points above mentioned.

To secure continuity of operation and ease of repair, form-wound impregnated coils should be used. Impregnation of coils is suggested because in many industries motors are subjected to moisture, steam, fumes, either acid or alkaline; dust, which may be organic, and which by its decomposition effects the insulation. Impregnation renders the coils much more immune to these conditions.

However good the motor may be, sooner or later repairs will be necessary, and in that case a form-wound coil is much more easily put in place than any other type. Coils should be made accurately to size, so there may be no difficulty in placing them in the slots, and there should be good mechanical connection between coils, as lack of this often leads to open-circuiting. It is also desirable to have a good terminal board, and preferably flat, flexible copper leads, so as to do away with soldered or screwed terminal connections. It would also be well to use particular care in the quality of the insulation on the copper bars in the rotor where they pass through the slots, as this would reduce the amount of labor in repairs. It is to be hoped that some better scheme may be devised for connecting the conductors to the outside rings, as bolts corrode, and it is seldom possible to remove them without twisting them off, which again occasion delay.

Bearings should be long, well designed, and filled with the best quality of babbitt. Great care should be given in designing the channels for the oil-rings to travel in, so there may be no chance for the ring to catch; and the sight-feed or overflow pipe should be piped away from the bearings, so that inspection may be given it regularly.

Shafts should be stiff, and the motor so designed as to permit of considerable overhang of the driving pulley. There is a tendency on the part of designers to increase the diameter of the driving pulley, narrowing the face in order to reduce the overhang; but at the speed at which most motors run, these large driving pulleys occasion difficulty in getting down to such speeds as are common in mill practice. In fact, the motors which so far have come under my notice have practically all had to be equipped with smaller, wider pulleys than those sent with them. This condition might as well be realized, and the motor designed for this service.

My experience has been mainly with a group drive, hence there is a chance of continual slow growth in the power requirements, and for that reason the motor should be capable of standing up to the load, even it in excess of its nameplate rating. A motor, therefore, should be designed to stand at least twenty-five per cent continuous overload without undue heating, and should be so designed as to permit of good ventilation and a ready access of the air jet in cleaning out.

Controllers, and particularly switches, should be of the oil-immersed type, doing away with fuses, thus meeting the requirements both as to fire hazard and to life, from contact with the average open-jaw switch. Experience shows that auto-transformers for use in connection with the induction motors furnished have almost invariably been too small, and after considerable trouble in endeavoring to start the motor, it has been necessary to secure larger ones. Designers may well consider this point and be more generous in their provision of capacity in these most necessary appurtenances. The user can well afford to pay a little more for a well designed motor containing some reserve in capacity and ability to stand hard usage, and it will be found to be a paying investment in the long run.

In the business in which I am interested (paper manufacturing), we have not thought it wise to take up the application of the individual motor to the individual machine, although this has been developed quite fully by the electrical engineers. We have so far made use of group drives, so arranging the groups as to make use of but a few standard sizes, of which we always keep one or two in reserve for use in case of emergency. The standard group might be said to be that driven by a 100 horsepower motor, of which we have twenty, and for which we constantly hold two extra motors in reserve, one of them on trucks ready to be hurried to any point required. In this way, should anything occur to a motor, it can be removed and a new one slipped in its place, with the loss of but a few moments, and the repairs made at the shop at leisure. This same practice holds good for all sizes up to 150 horsepower, above which this scheme is not practicable.

After the last paper was read the meeting was turned over to D. B. Rushmore, chairman of the industrial power committee of the American Institute of

Electrical Engineers. The discussion of all the papers jointly was then carried on. Several gentlemen submitted written discussions. The discussion on the whole was quite spirited. Those who participated in it were: J. C. Parker, Chas. B. Burleigh, Norman T. Wilcox, H. B. Emerson, N. W. Dalton, H. W. Peck, R. D. Wolf, Albert C. Pearson, H. D. James, C. A. Grass and J. H. Gardiner.

The Disaggregation of Ferrosilicon in Humid Air, and its Consequences.

Ferrosilicon is at the present time extensively employed in the industries, and its production in the electric furnace has raised some economic problems which have been unexpectedly complicated by sanitary questions. Certain electrically produced ferrosilicons have the property of falling to dust after a while, sometimes days, sometimes weeks, but always very soon. During this disaggregation gases are liberated, such as phosphuretted hydrogen, or even arsenuretted hydrogen, which are toxic and an accumulation of which may create mortal danger. The question of packing and transporting this product is therefore one that requires careful consideration. A commission appointed by French manufacturers for the purpose of discovering ways to obviate the danger has found that the toxicity of ferrosilicon depends on the proportion of silicon it contains. There are certain dangerous or "critical proportions," outside of which ferrosilicon is said to be harmless. This will seem strange, for the gases mentioned can be generated only by impurities foreign to silicon, but the explanation is that the dangerous proportions are those at which ferrosilicon is unstable; it therefore disaggregates of itself and facilitates the action of exterior humidity on any impurities it may contain. The commission proposes the complete abandonment of the manufacture of ferrosilicon of "critical proportions," which are now known to be those from thirty to forty per cent and from forty-seven to sixty-five per cent. "By deviating considerably from these critical percentages," says the commission, "we would have only perfectly compact ferrosilicon capable of being packed and transported with as little danger as ordinary pieces of castings."—*Abstracted from La Lumiere Electrique (Paris), December 11, 1909.*

Tests of Tungsten Lamps.

The engineering department of the University of Illinois, Urbana, Ill., has just issued Bulletin No. 33, which records at length the results of a series of tests of tungsten lamps conducted by T. H. Amrine and A. Guell. These tests were conducted over a year ago and were made on two types of German imported lamps and one type of American lamp. One hundred lamps of each type were secured for the tests. The bulletin records the results obtained chiefly in graphical form as a set of very clear curves.

Probably of greatest interest in these experiments were the life tests, to which fifty lamps of each type were subjected. Half of these were burned upon a well regulated voltage supplied by a storage battery; the rack supporting these lamps was mounted on coiled springs so as to eliminate vibration as much as possible. The other twenty-five lamps of each type were operated on a badly regulated sixty-cycle circuit. The rack supporting these lamps was rigidly fastened to the floor, and thereby subjected to all the vibration of the bulding. The American lamps came out best by a very decided margin in these tests.

As the three types of lamps tested differed not only in manufacture but also in the method of mounting the filament, no positive conclusions could be reached in regard to the exact effect of each of these factors. The efficiencies, life and other characteristics that were ascertained as a result of these tests have been greatly improved

The Earth as Return Circuit in Power Transmission.

The report of a committee appointed to investigate this question furnishes some new information regarding it. The first experiments made to determine whether it is practically possible to utilize the earth as a return conductor for heavy currents date back to 1892. They were carried out by Mr. Thury on the direct-current transmission line between St. Maurice and Lausanne. The tests showed a decrease of 118.5 kilowatts in the loss over that sustained when both metallic conductors of the line were utilized. The possibility of saving one-half of the copper in the line and at the same time decreasing the loss of energy was thus regarded as demonstrated.

Following these preliminary tests the committee referred to was appointed by the Swiss Association of Electricians to pursue the investigations. Experiments were carried on by the same in 1906 and 1907, which led to the presentation of a petition to be permitted to operate normally with the earth as return circuit, but the telegraph department of the Swiss Federal Railways objected on account of disturbances caused by the return current to the telegraph circuits. These disturbances were finally removed by compensating the differences of potential created in the telegraph circuits by means of local batteries. Since July, 1909, the line has been continuously operated with the earth as return circuit, after installing compensating batteries at the place where experience has shown them to be necessary. The service can be changed from "earth" to "line" within three or four minutes. According to the report the supply of electricity in the city of Lausanne is effected with as much safety as if the transmission were independent of the earth. The committee has been able to make numerous measurements which permitted the clearing up of a number of questions raised. The results of the measurements have not yet been published, but it is stated that the practical possibility of permanently utilizing the earth as return circuit for this work has been demonstrated.—*Abstracted from Revue Electrique, Paris, January 15, 1910.*

Railway Telegraph and Telephone Appliance Association.

Pursuant to a call of a temporary committee, a number of manufacturers' representatives assembled in New York city recently and organized the Railway Telegraph and Telephone Appliance Association, the membership consisting of associate members of the Association of Railway Telegraph Superintendents.

A constitution along the lines of that of the Signal Appliance Association was adopted, and the following officers elected for the ensuing year: P. W. Miller, of the Kerite Insulated Wire and Cable Company, chairman; A. P. Eckhert, of the National India Rubber Company, vice-chairman; Hiram M. Buck, of the Railroad Supply Company, secretary and treasurer.

The primary object of this association is to arrange for the display of telegraph and telephone appliances at the meetings of the Association of Railway Telegraph Superintendents.

THE DAMAGE TO THE ELECTRICAL UTILITIES BY THE PARIS FLOOD.

BY OUR FRENCH CORRESPONDENT.

The flood at Paris did a great deal of damage to all the electrical public utilities, particularly their stations and underground mains in many parts of the city. Most of the electric tramway lines stopped running for lack of current, and the Metropolitan subway was also obliged to stop running trains on various sections, as the tunnels were flooded. The disastrous effects of the flood were not confined to the parts of the city lying immediately along the Seine, but the water backed up through the large sewer conduits and also through the North-South subway tunnel, which is now in construction, thus reaching the center of the city and flooding quite a number of points.

The electric lighting plant belonging to the Compagnie Continentale Edison in the Rue Bergère had its basement flooded and was obliged to shut down in consequence. The underground lighting mains of this company are among the largest in Paris and are laid in underground tunnels of considerable size. These are also flooded and the whole system is thrown out of service. It is not known when this can be set to rights. Another large system of mains which is fed from the Asmères station in the suburbs is out of working, as the station is flooded. Only the engine plant suffered from the water, however, and the generators and transformers are safe, so that the plant will be able to start up as soon as the water subsides. This is not the case for the great Moulineaux plant which furnished current for the lighting mains in the southern districts of the city. As it lies next the Seine and on low ground, the station was completely flooded and is in a very bad state. The large alternators as well as the transformers are so damaged by the water that they will be unfit for service. It will take so much work to put the plant in working order that the operating company hesitates to undergo the expense, and is talking of abandoning the plant and using current from the St. Denis station for feeding part of the city mains which it operates, while waiting for the construction of a new plant in conformity with the plans laid out by the union of lighting interests which is to centralize the city supply and mains in 1913. The mains in the Opera quarter have also suffered and the connection is cut off from the St. Denis station. The electric plant at Billancourt in the suburbs is also flooded, which cuts off a large amount of current from the south side of the city.

The electric traction lines are almost all thrown out of service, either from being flooded or from lack of current.

FLOODED STREET NEAR A METROPOLITAN STATION.

A TYPICAL FLOODED STREET.

One of the lines to suffer most is the electric branch of the Orleans Railroad which passes along the Seine for some distance and for some portions as an underground line. The great station at Quai d'Orsay is entirely flooded and there is more than ten feet of water above the tracks. The tops of a few cars are to be seen above the water as well as the roof of an electric locomotive. As to the tunnel portion and all the rest of the tracks these are quite submerged. Much work will be needed to put the line in running order as the tracks will need to be re-laid, along with the third rail and other electric fittings. Farther along the Seine, the Invalides Underground station is submerged. One of the accompanying views shows the overhead building also

THE INVALIDES STATION—THE UNDERGROUND PART COMPLETELY SUBMERGED.

FLOODED QUAI D'ORSAY STATION—WATER AT SECOND-FLOOR LEVEL.

surrounded by water. This is the starting point for the electric railroad leading to Versailles. Needless to say, the Versailles line is not operating at the present time.

The Metropolitan subway system is operating only a part of its lines, using current from the St. Denis plant, as its own station lying on the bank of the Seine is flooded. The water has not risen to the level of the generators, however, and it is thought that this plant will suffer less than some of the other stations. Most of the subway tunnel in proximity to the Seine is flooded, but other portions of the line were able to continue running, either in the tunnel or on the elevated parts in the various districts. Considerable damage was done by the flooding of the new North-South tunnel under the Seine which is now in construction. From here the tunnel leads through the heart of the city so that the water backed up for a long distance, reaching the St. Lazare railroad depot, which received considerable water in this way. The construction work for the new subway lines in various points was also flooded for this and other reasons, in some cases by the water which backed up through the main sewers.

Nearly all the electric tramway lines leading to the suburbs have stopped running, and most of the lines within the city. Fortunately there are left the horse omnibus lines and the autobus, and the compressed air tramway lines are unaffected.

As most of the telephone cables are run along the top of the large sewer conduits, they were put out of service in many cases and quite a number of subscribers are cut off. The cables cannot be reached to repair them until the water subsides. Owing to the flooding of the central telegraph offices, the telegraph service was much disorganized and communication to various cities in France as well as to foreign countries was cut off.

A. DE COURCY.

Paris, February 9, 1910.

Commonwealth-Edison Operations.

The 5,000 kilowatt frequency changer at the Quarry Street station, Commonwealth-Edison Company, Chicago, is now supplying a sixty-cycle current at 12,000 volts to the Troy Steel substation and is also supplying, indirectly, a 4,000-volt current to the Twenty-Second Street and Bridgeport substations.

Rubber Production in the United States.

The United States has recently entered the list of rubber producing countries and a factory for the manufacture of crude rubber from the guayule shrub has been in operation night and day at Marthon, Texas, for several months. It already has a large output of crude rubber and so profitable is the industry that the capacity of the plant is being doubled. The product is shipped to New York where it is refined and used for various purposes by the rubber trade. It is claimed that the guayule rubber is especially suited to the manufacture of automobile tires and that it is used chiefly for this purpose.

The development of this industry is due to Otto Wahrmund of San Antonio, who might be called father of the rubber industry in this country. He became interested in the manufacture of rubber from the guayule shrub in Northern Mexico a few years ago, and, in the course of his investigation as to the source of the crude supply, he discovered that the desert shrub not only covered many millions of acres of land in the states of Zacatecas, Coahuila and Nuevo Leon in Mexico, but that the growing area extended into Southwestern Texas for 150 miles. He found that in the territory around Marathon the shrub was especially plentiful. It extends from Marathon all the way to the Rio Grande, a distance of ninety miles, and has a breadth of territory running east and west more than two hundred miles.

OTTO WAHRMUND.

On the erection of the factory at Marathon by Mr. Wahrmund, he contracted for the guayule shrub upon many of the large ranches of this section. The state of Texas owns several million acres of land in this region, and the valuable shrub grows in commercial quantities upon much of it. Not realizing the extent or value of the product the state land commissioner a few years ago sold the right to cut and use the guayule shrub upon all of the public lands to the representative of a large rubber manufacturing concern which operates in Mexico. The owners of this valuable right are preparing to establish a large factory for the utilization of the product in this section. The factory at Marathon has passed out of Mr. Wahrmund's hands and is now owned by a syndicate of men who are said to be connected with the rubber trust interests.

It was less than ten years ago that the discovery was made that rubber could be manufactured from the guayule shrub. Since that time more than thirty million dollars gold has been invested in the industry in Northern Mexico. One factory alone, situated at Torreon, Mexico, owned by a subsidiary concern of the United States Rubber Company of New York, represents an investment of $2,000,000 gold. This same concern owns one solid tract of land embracing 2,500,000 acres upon which the guayule shrub grows profusely. It also owns a number of other factories in that country. The present crude rubber output of the guayule factories in Mexico is about one thousand tons per month, valued at more than $1,000 gold per ton. From this the value of the industry is seen.

The permanency of the guayule rubber industry in Texas is said to be assured. It has been demonstrated that the shrubs can be easily grown from the seed and that they can by proper attention be made to attain a commercial size in three years after the planting. The propagation of the shrub is to be extensively carried on in the region around Marathon and in several other places.

Three-Cent Fares for Cleveland.

As a result of the vote cast in Cleveland, Ohio, on February 17, the three-cent street car fares have gone into effect in that city. The Taylor grant provides that a test of this rate shall be made for a period of eight months, at the end of which time the rate may be raised if the profits have been less than six per cent. The maximum fare is four cents, during the life of the grant, which is twenty-five years from the time of its enforcement.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

THE SUPPLY OF ELECTRICAL POWER FOR INDUSTRIAL ESTABLISHMENTS FROM CENTRAL STATIONS.[1]

BY R. S. HALE.[2]

The general question of whether a large station can supply power more cheaply than several small ones is one that hardly admits of argument. Still, in order to satisfy myself as to whether 1000 or 2000-horsepower isolated power plants for mills diverge except in detail from the general principles that have produced our existing central station, I asked the engineers of the construction bureau of the company with which I am associated, these questions: (1) What would be the cost of power in a station that you would build to-day to supply about 2000-horsepower? (2) Suppose you had to supply the same at each of ten scattered points within a territory 100 square miles, what would the power cost from a big central station?

The point of asking for both figures from one office was to be sure that both were on the same basis: that if the cost of turbines, for instance, should be taken too low, or too high, or if the cost of labor were taken too high or too low, nevertheless the same basis would be used on both sized plants and would produce no error when comparing the two propositions.

There are, of course, two kinds of errors that we are subject to. If one man makes an estimate for both sets of conditions, then even if there are errors or omissions, as, for instance, if we have figured the price per ton of coal too high or too low, or if we have figured 10 per cent depreciation against an actual 3 per cent, or have omitted taxes altogether, still the comparison is, on the whole, correct even if both sets of figures themselves are a good deal out of the way, since they would be out of the way by the same proportion in each case.

On the other hand, if instead of comparative estimates we take actual results in plants that have run long enough to give results, we find that the comparison is never on the same basis. One man has bought turbines when the manufacturer was willing to cut prices; the other has run into quicksand in his foundations or unusual labor troubles; and although the individual figures in each actual case must be much more correct than in the estimates, yet there is no question but what accidental items affect tremendously the actual costs in individual cases, so that the comparisons based on actual correct figures are often very erroneous comparisons.

Our engineers' figures, however, are on the same basis for both small and large plants. I will not take time to present their figures in detail but they figured that ten plants of 2,000 horsepower each cost $980,790 per year to deliver their power, and one large plant to deliver the same power, including distribution expenses, $739,580 per year —a saving of twenty-five per cent.

No one should expect any other comparative results. When the Edison Electric Illuminating Company of Boston owned plants of from 100 to 2,000 horsepower capacity each in Somerville, Dedham, Milton, Newton, etc., it found it paid to abandon them and establish one big generating plant at L Street in Boston and distribute the power to outlying districts.

When the Pacific Mills in Lowell, or Swift and Company in Chicago, concentrate all power in one large power house instead of one plant for each building, it is because central station power is cheaper than small scattered plants.

It is safe to say that a good engineer who has a chance to make a saving for his clients would seldom advise a dozen small plants as against one large one.

The real question is not whether large stations are cheaper than small ones, but the question is: Why do not the present central stations take all the present business when it can so surely be supplied at a less cost to the community if supplied from a central station?

The question is: Why are any small plants left? The real question is not as to the facts, but as to the reason why we do not take advantage of the facts.

Now the figures usually assumed as the cost of supplying power to the small plants from a large central station are somewhat different from the prices the central stations will actually quote. The question is, therefore, not whether central-station power is cheaper than power of a private plant, but whose fault is it that there should be so much difference of opinion as to the actual cost in particular cases? In my opinion, both sides are to blame. The central station has, to a large extent, failed to realize its opportunity. Also, the builders, or rather promoters, of the small plants usually figure much too low for the real commercial cost, and all of us, even when we have thought clearly ourselves, have failed to get the exact knowledge sent home to the general public.

Now why should the central stations, who are not making fabulous profits, insist on such high prices instead of giving the customer at least part of the advantage of the reductions in cost that everyone agrees ought to come with central supply.

The first thing is to analyze the actual central-station figures and find where the money is going. We find on taking published figures of central stations certain large items that are nearly or entirely omitted by private plants. The cost of billing and collecting, for instance, is a large item in central station costs.

The size of these items is obviously due to the number of small customers. On the other hand, with twenty large customers, or even one such customer, it would amount to something, yet it is

1 Abstract of a paper presented at a joint meeting of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, Boston, Mass., February 16, 1910.

2 Superintendent of the Sales Department, Edison Electric Illuminating Company of Boston, Mass.

practically negligible in comparison with the bills rendered. Again, for a few large plants we have figured ten per cent loss from the central station while the actual central station of to-day reports thirty per cent. For a few large customers ten per cent is correct and again the high figure for the existing central station is due to the number of small customers who use transformers at a poor load factor. For a few large plants, we figure only a small distribution expense, while the actual central station spends far more for distribution than for manufacturing, and as before stated, this is because the existing central station has a lot of small customers.

The combination of big with little does not necessarily add to the cost of either and more usually saves on both. The wholesale department of Jordan, Marsh and Company, dry goods merchants, is not handicapped by the retail store of the same company but the wholesale and retail departments complement each other. If a central station for a few large wholesale customers should add retail network and get enough income from the retail to pay all the additional costs, it would not add to the cost of supplying the wholesale, although the average cost per horsepower delivered to all the customers might and would go up.

Up to within a very few years, central stations have had only a retail business, and have not realized that they did not increase distribution expenses proportionately by adding a few big customers. Up to within a few years central stations figured on their average costs of retail business and thought that the big business was a loss because it would not bring as much per kilowatt-hour as their average costs. To-day, they are beginning to realize that it is per cent on investment and not cents per kilowatt-hour that means profit; but business of to-day is the result of prices of three years ago; it takes time to develop. Even to-day, however, few central stations realize the field that they should cover. Unjust critics are to a certain extent responsible for this, as central stations depend on popularity. A central station making five per cent on its investment from the proceeds of retail business, seeing that a low kilowatt-hour price to a big mill means a six per cent return on the investment for that customer and an accompanying later reduction in price to its small customers, hesitates to make the price necessary to secure the large customer because the big differential furnishes an apparent argument to those who claim that central stations are favoring large customers against the small, and five per cent with popularity is better than six per cent with unpopularity, even if in the latter case the small customer is getting his price actually lower.

Central stations have been weak in not analyzing their expenses properly, but the owners of small plants have likewise failed to analyze their expenses as between their plants and the rest of their business.

When a central station figures that doubling its kilowatt-hours by selling ten million more to a single customer will add to its distribution expenses as much as if it sold them to ten thousand customers, it makes a very serious error. On the other hand, it is sure that every additional piece of business added adds something to the expenses all along the line; in some cases more, in some cases less. There are a great many expenses of a business that must be paid but cannot be said to be part of the cost of any particular portion. These are what are sometimes called the general expenses, but they often have other names. For instance, the salary of the president's office boy is not obviously part of the cost of unloading coal, and yet we know pretty well that if we should unload five times as much coal as we do now, the expenses of the president's office would go up.

The cotton mill seldom figures any of the interest on its floating debt against cost of power, and yet the money tied up in the coal pile must be drawn from somewhere and must earn its interest somehow.

Each item is in itself usually small, but in some isolated cases there are often extra expenses that run into big figures.

Once I prepared some estimates for one of the best engineers we have, one of the men who is now doing things rather than engineering them. He said to me, "Hale, your estimated figures are all right so far as they go, but remember that the expenses that really count in business are those that you don't figure on." In my own department I am always tempted to figure that when I add another salesman at $100 a month, I am adding only $1,200 a year to my expenses. I have, however, taught myself to remember that he will need a desk, part of the office, rent, part time of a stenographer, office boy, etc., and these all cost money. A stock exchange broker once told me that when he hired a salesman, the commissions on the business the salesman brought in must be four times his salary, otherwise the salesman was really a loss.

Now, just as central stations have figured the costs of adding large customers to their retail business too high, so the mill in its analysis has failed to remember that its power plant involved other expenses besides those it figured on.

Now, if the engineer has included all the items, viz., interest at the same rate of profit the owner wants on all his business depreciation figured not on the time the plant might last but on the date when he will scrap it, taxes, insurance, coal, water, labor, repairs, rent, removal of ashes, loss due to noise, loss due to vibration, loss due to dirt, loss due to non-flexibility, loss due to extra cost of running overtime, extra cost for superintendence including the time spent in hiring and discharging engineers, purchasing coal and supplies, checking records, etc., etc. (these all should be added), and if after all the expenses are included the plant shows a less cost than purchased power, it should be put in. When an owner says he will pay twenty per cent more for purchased power than it would cost him to generate it for himself, he is really saying, "My engineer is sure to omit twenty per cent of the real costs;" and just as the central station of to-day has a tendency to figure costs of supplying big power too high, the actual isolated plant of to-day figures its costs too low.

The projectors of isolated plants often lay stress on the special advantages of a separate plant for some particular case. This is usually in connection with the use of exhaust steam. One of the isolated-plant advocates told his client that he could use his steam three times; first, for power; second, for heating by exhaust steam; and get a third supply of heat for evaporating sugar or in chemical processes.

There is no question about the theoretical advantage of using the exhaust steam for heating, but if the practical advantage followed the theoretical then the central stations should be putting down small plants in the centers of cities and selling steam heat in local blocks. If the central stations find this

does not pay, and practically every one of them has tried it at some time or other, then the chances are that it usually does not pay. The same idea applies to many of the other special cases.

A further difference between a small plant and a central station is that there is an actual difference in the thing supplied in two very important ways. One is quality of service. Theoretically, a small plant can often give as good service as a large one. Practically, the large one gives wool against cotton in many ways. The steadiness and reliability of the power in every way is, as a matter of fact, much greater for central-station power. This costs more and is worth more and often the central station has not any poor service to sell at a low price. This is a special condition that is really more frequent than the question of steam heating. A business that is fully satisfied with cheap and irregular power at a low price can often make that quality of power itself better than to buy a good quality of power from the central station.

A second is that the isolated plant supply is inflexible but the central station supply is flexible. An isolated plant, if figured on depreciation of three per cent, must be used a quarter of a century. Even at ten per cent, it must be used a long time; and, more than this, no plant is like the one-horse shay, it can never be discontinued without a loss. On the other hand, central-station supply in many cases can be discontinued at the will of a purchaser on a moment's notice. In other words, with central-station supply, the purchaser is free; with a plant he is tied like a serf to the investment he has put in.

It is true that this freedom for the purchaser can only be given at an expense to the central station. When the central station must be prepared to lose a customer at a moment's notice, or a month's notice, it cannot make its arrangements as economically as if it counted on running along exactly the same year in, year out, as the mill that has its own plant must do in order to make the plant pay. Part of this condition can be and is taken care of by long-time contracts. If a central station can figure that its investment for a particular customer will be used for all time and will not be discontinued at some definite or indefinite date, it can supply power more cheaply. On very large business, it must get this assurance by long-time contracts; on small business by its own judgment of the future; but even with the longest and strongest contracts made with the central station the mill is freer when purchasing power than with its own plant, since at the end of the contract it discontinues without loss, while with a plant of its own it can never discontinue without loss. Perhaps in special cases this freedom may not be worth anything, yet it is safe to say that in general the central station sells better power and allows more freedom than the isolated plant can give.

To summarize:

1. Central-station power can, except in very unusual and special cases, be supplied more cheaply than when a man in another business attempts to make power as well as to carry on his own business.

2. Central-station power is practically always better and gives the private owner more freedom and flexibility.

3. The existing central stations have in the past figured the cost of their power supply in large lots too high, and have unconsciously hurt themselves and the public by attempting to charge large customers too much.

4. When central stations have made proper prices, the people who do other kinds of business have hurt themselves and the public by figuring their own costs of power too low and not charging their own time and general expense against the added business responsibility of the plant.

In future, the central stations will come closer to the other businesses; all will get together and pull together, and an isolated power plant will, before many years, be just as scarce as an isolated plant for making gas is to-day.

Increase in American Institute Membership.

On February 1, 1910, the membership of the American Institute of Electrical Engineers comprised one honorary member, 631 members, and 5,859 associates, thus making the total 6,491. On the corresponding date in 1909 the membership was one honorary member, 602 members, 5,685 associates, or a total of 6,288. Thus the increase during the year has been twenty-nine members and 174 associates, or a total of 203. At the directors' meeting on February 11 seventy-five associates were elected and three associates advanced to the grade of member.

A New Ferro-Concrete Pole for Transmission Lines.

A German firm has recently brought out a new type of ferro-concrete pole for transmission lines, which possesses several commendable features. The pole is rectangular in section and is perforated throughout its length, except, if required, for some few feet near the bottom, so as to reduce the weight of the pole and the pressure of the wind, and also to form rungs for climbing. The poles can be cheaply made at or near the points of erection, and thus the cost of transportation is greatly reduced. Erection of the line is simplified and cheapened, for no ladders are needed for this purpose. It is understood that several thousand of these poles have already been utilized in Germany, and that they have been received with favor.

Gas Engines in Africa.

One firm in Africa has supplied over 100 suction-gas-engine plants during the last two years, says *The Engineering and Mining Journal*. The largest was of 230 horsepower and the smallest of six horsepower, with an average capacity of forty horsepower. Charcoal is the fuel in the majority of plants though producers are furnished and guaranteed to operate on semi-bituminous coals. The charcoal consumption per brake-horsepower-hour varies, depending on the per cent of full load carried by the engine and its size, but the consumption rarely exceeds two pounds. While the cost of a gas-power plant complete is about twice that of a similar steam plant, the power cost per hour is 5:8 in favor of the producer plant and gas engine.

Industrial Power Developments in Scotland.

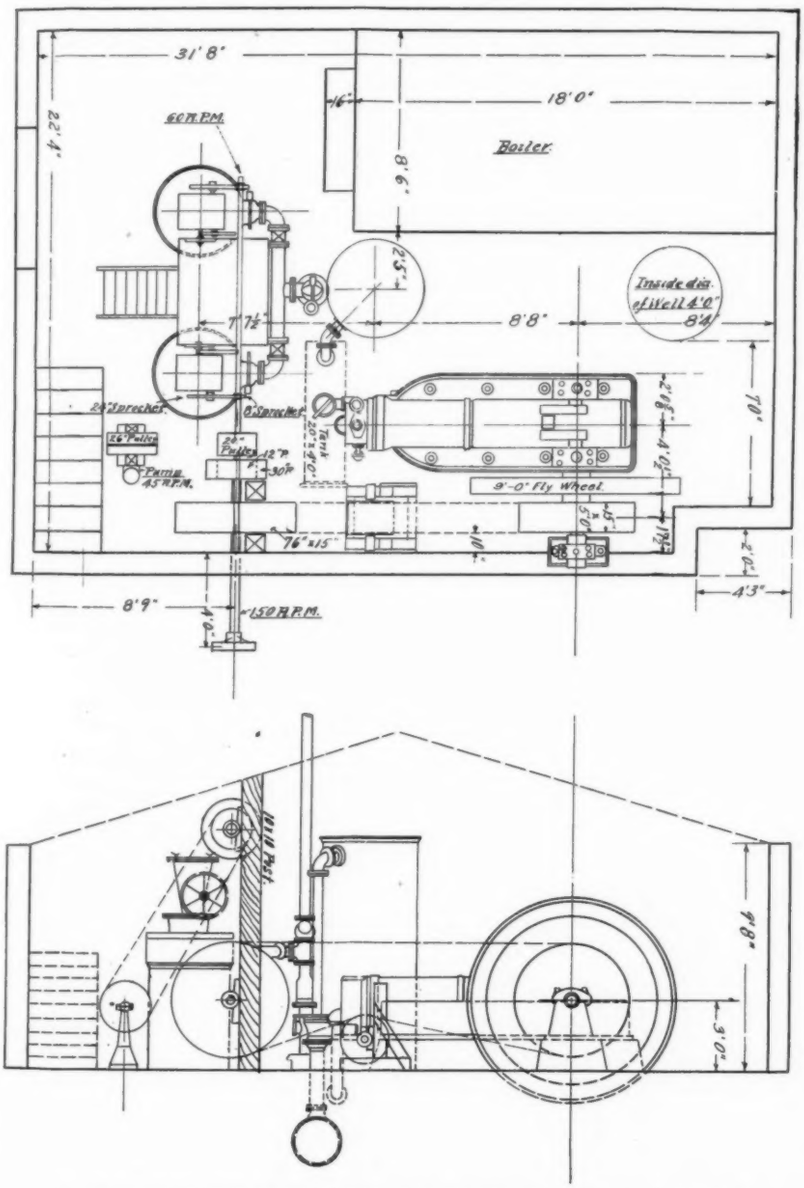
Among the many electrical developments that are taking place in Scotland may be mentioned the electrification of Lobnitz and Company's shipbuilding yard at Renfrew, on the Clyde, which will have all its plant electrically driven by three-phase current from the mains of the Clyde Valley Company.

At the Rothesay Dock, Glasgow, two large electric transporters are being constructed, and two electric coal hoists are in course of erection on the north quay of that dock. Practically all of the auxiliary machinery used at this dock is operated by electricity.

A SUCCESSFUL EXPERIENCE WITH A PRODUCER-GAS-ENGINE PLANT.

BY WM. B. PATERSON.

The accompanying diagram is the original layout of a gas engine and producer plant now operated by the author at Rugby, N. D. Some changes from this drawing have been made inasmuch as the producers have been turned through an angle of ninety degrees around the scrubber, and the large boiler has been taken away.



PLAN AND SECTION OF PRODUCER-GAS-ENGINE PLANT AT RUGBY, N. D.

The engine is of the Munzel type, was built by the Minneapolis Steel and Machinery Company, and installed by them at Edinburgh, N. D., when the writer took charge. It was operated for two years, and during that time gave entire satisfaction. The mill was then destroyed by fire but the engine was not damaged to any great extent. It was purchased by the Rugby Milling Company in June, 1909, when the author entered the employ of this company, took down the plant, moved it and installed it at Rugby, N. D.

The power plant is of eighty horsepower, and consists of two producers, which are used alternately or together.

Several important changes have been made by the writer. When the plant was first installed the force draft entering the bottom of the producer caused a slight pressure to escape to the atmosphere, which did not prove practicable. Therefore, the suction fan was piped from the top of the producer, this having the same effect as a chimney, which proved satisfactory. One feature which may be noticed is quite an advantage, and that is, re-using the cooling water from the engine instead of letting it go to waste. This is not usually done with this type of engine. To overcome the scarcity of water, a large tank had to be sunk in the ground. By arranging open cooling troughs the water was cooled sufficiently so it could be used over again. In some localities where water is hard to get this system would be of great benefit.

The plant has run constantly day and night for the past four months, developing steady and entirely satsifactory power. We are using a trifle less than 1,500 pounds of anthracite pea coal per twenty-four hours, developing sixty horsepower, which would be practically one pound of coal per horsepower per hour. The Rugby mill was formerly operated by a twelve by thirty Corliss engine, requiring two and one-fourth tons of the best bituminous coal per twenty-four hours.

New York Subway Construction.

Up to the present, New York has spent for subway construction $59,206,423. This includes the Manhattan portion of the Brooklyn loop lines, on which $6,951,955 have been expended.

With about $76,000,000 now available for subway construction, because of the $26,000,000 increase in tax assessments, the Public Service Commission is satisfied to know that the present year will witness few drawbacks. The Board of Estimate and the Bureau of Municipal Research are working in complete harmony with the commission, and it is expected that the special committee appointed by the board will soon present a workable report. There are before the officials six different propositions for subway construction.

Smoke Agitation in Grand Rapids.

Grand Rapids, Mich., is considering the abolishment of the smoke nuisance in that town, to which end it is proposed to install automatic stokers and to use smokeless coal in the new pumping and lighting station.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ILLUMINATION FOR INDUSTRIAL PLANTS.[1]

BY G. H. STICKNEY.

The problems of industrial illumination include the lighting of offices, yards, elevators, stairways, and other accessories, but it is the purpose of this paper to treat principally of artificial illumination for the actual processes of manufacture.

Electric light is being adopted generally as the standard of the best practice, furnishing the safest, most convenient, and usually the most economical illuminant available, therefore this paper will treat of electric lighting only.

All industrial processes are subjected to a close cost-scrutiny. Pressure is placed wherever it seems possible to reduce cost. The lighting bill, holding as it does an indirect relation to the resulting product, is often discriminated against. Although it is seldom practicable to estimate accurately the relative values of different degrees of illumination, it is well known, however, that an average workman can do more and better work with an illumination of suitable intensity than with a weaker light. Figures have been published which show the relative rate of production by daylight and by artificial light in particular installations. In every case the superiority of daylight has been startlingly demonstrated. Unquestionably in the majority of manufacturing plants to-day, raising the standard of illumination would justify its cost, in the improved quantity and quality of production.

In revising the lighting of plants to take advantage of new developments, the manufacturers have in a number of instances expressed surprise at the marked improvement in production due to the better illumination.

The operative is an important factor for consideration in any lighting proposition. Since the light is provided primarily for his use, in order that he may perform his work advantageously, it follows that it should be suited to his needs. To be satisfactory the illumination should enable the workman to perform his work quickly and well, without excessive eye-strain. The illumination can increase his efficiency by making him at ease with his surroundings, or it can render him dissatisfied.

It is seldom practicable to equal daylight, and therefore it is usually advantageous to pay as little attention as possible to the artificial lighting. One of the serious objections to placing a small portable light under the control of the workman is that he is inclined to experiment with it, not only wasting his time, but often placing the light so as to produce a glare in the eyes of his fellow workman or himself. Such an arrangement is soon followed by eye-strain, and the workman feels a desire for more light. An increased light only makes matters worse, and at the same time calls for a higher current consumption. We have revised such installations when it was possible, cutting the current consumption in two, by going to general illumination and still providing ample working illuminations.

Such a change is usually resisted at first by the workman, partly because the strained condition of the eyes makes it require more light for clear vision, and partly because the workman thinks an inherent right is being taken from him. If the change can be made diplomatically, perhaps providing additional intensity for the first few days, it is not unusual that a considerable reduction can be made, and at the same time a light furnished which is really better for the employee. In making such a change the operator should understand that the new system is an accepted success elsewhere. If it is treated as an experiment and the workman's opinion asked, he is apt to become over-critical.

The lighting system in any building or room should be arranged so as to fit the conditions. Likewise the building should conform as far as possible to the requirements of good lighting. The finish of a room affects the efficiency of a lighting installation considerably. A dark finish is rich and pleasing to the eye, but in a workroom it is often extravagant. Whitening the walls, pillars and ceilings of a room will produce a remarkable increase in the effectiveness of the light.

A high-studded room sometimes requires more power to light than a lower room, but it permits the use of larger units with wider spacing. This is desirable from an installation and maintenance standpoint. It is common practice to space lamps one and one-half to two times as far apart as the height above the work.

Especially in large rooms the use of low glaring lights should be carefully avoided, as the lamps brought together by perspective are distressing to the eye. The higher the lamps are hung the less the necessary precaution to avoid glare. Modern factory buildings have as large window areas as possible. While this construction increases the effectiveness of daylight, it requires a higher intensity of artificial illumination. This is partly because operators accustomed to strong illumination require relatively strong artificial illumination, and partly because of the loss of the artificial light through windows. Where conditions permit the use of white curtains, much light can be reflected back and retained in the room. It is well in arranging lamps in a room to favor those parts which have the best daylight, because in arranging the work the processes requiring the most light are located near windows.

There are two principal ways of lighting a room; namely, by local illumination and by general illumination. Where the former method is followed, a small lighting unit is placed at each point where particular illumination is required, the remaining parts of the room depending on stray light or a low general illumination. For general illumination, the room or section is lighted by

1—Abstract of a paper read at Boston, Mass., on February 16, before a joint meeting of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

systematically placed units so arranged that all parts receive approximately the same illumination. Relatively large lighting units are used, depending in size upon the dimensions of the room and degree of illumination required.

With general illumination the arrangement of lamps, being independent of the detail location of machinery, does not require change with rearrangement of the work. General illumination does away with temporary construction and unsightly drop-cords, and the accompanying high depreciation, and, in many cases fire-risk. The use of drop-cords among stock shelves is especially to be deprecated, on account of the lamp down where there is danger of causing fire. With properly labeled shelves, a permanently installed lamp above the aisle will provide necessary illumination.

When lighting processes in an open room, general illumination can be used economically where work is concentrated, but where there are just a few widely separated points that require light the method of local illumination will be the cheaper. The choice between the two methods often depends upon the process. General illumination gives a softer and better diffused light, but will not furnish light in a deep boring as readily as a specially placed local lamp. General illumination permits the use of the most efficient illuminants, with least wiring and maintenance expense.

In order that a process may be properly illuminated it is necessary that it should be understood by the illuminating engineer. He must know how the light is to be used, in order to determine intelligently the most desirable itensity, degree of diffusion, direction, and color of light. In a textile mill, for example, the weave room is more exacting in lighting requirements than the spinning and carding rooms. Colored goods require more light than white goods. Different types of looms have different requirements as to direction of light. In high-grade work where there is shading of colors, white light is demanded.

An interesting intensity problem was presented by a leading rifle manufacturer, who was unable to obtain suitable artificial illumination on the targets of a 220-yard testing range. Measurements showed that the marksman required twenty-five to thirty foot-candles for satisfactory work. Daylight intensitites were running as high as sixty or seventy foot-candles, but the artificial illuminants, as installed, were giving only about six or eight foot-candles. An equipment which gave about thirty foot-candles was installed and gave immediate satisfaction. Later it was decided to eliminate daylight altogether, as the steadier artificial light gave more uniform results.

In machine shops, general illumination can ordinarily be used to good advantage, although some special operations require local lighting. Such local lighting is sometimes provided by loaning extension lamps to the workmen on check, after the practice followed with tools. This practice is often used for automatic machinery, where special light is required for setting up, though a low general illumination is suitable for regular operation. Ordinary machine-shop work requires about three foot-candles, though for rough work one foot-candle is often satisfactory, while for fine work six or more foot-candles may be required.

The presence of many overhead belts makes the elimination of shadows with general illumination more difficult, and also is apt to be destructive to drop-lights. Modern shops use as few overhead belts as practicable.

In a large clothing factory recently completed remarkably satisfactory results are being obtained by general illumination from tungsten economy diffusers. This suited all processes, the number and size of lamps in each diffuser being varied to meet the intensity requirements of the different departments. Some difficulty was found in seeing the seam at the middle point of a sewing machine when working on black cloth. This ordinarily would require a local lamp. Preliminary experiments with a local reflector for casting a special beam of light at this middle point indicate that this form of local lighting can be satisfactorily applied.

In drafting rooms at least six foot-candles should be provided on the drawing board. The selection between general and local illumination depends upon the arrangement of the room and other conditions. Where local lighting is used lamps should be shaded to cut off glare, and if possible located out of the draftsman's reach over the table and a little to his left.

The circuits for feeding factory lighting are usually determined by the central-station current available, or the requirements of the electric motors in the plant. Either direct or alternating current can be used to equally good advantage for lighting, except that arc lamps do not give a steady light on twenty-five-cycle circuits. Wherever possible the voltage of the lighting circuit should be between 100 and 125, as the most efficient lamps are more readily applied to these voltages. A 220-volt, three-wire circuit is commonly used to good advantage.

Where motor service is intermittent, affecting the voltage regulation of a local circuit, it is desirable to separate the lighting and power circuits as far as possible. In some of the largest textile mills in New England, where the supply is alternating current, the general illumination is provided by means of series direct-current arc lamps. This furnishes a white light with remarkable economy of current consumption and maintenance. Series circuits in general, however, should be avoided except when they can be safeguarded.

The lamps available for industrial illumination may be considered under two classes; namely, incandescent and arc lamps.

The principal types are as follows:

Incandescent:	Arc:
Carbon.	Enclosed carbon.
Glower.	Intensified carbon.
Tantalum.	Mercury.
Tungsten.	Luminous, magnetites
	Flame carbon.

None of these lamps is suitable for all conditions of lighting. It is often desirable to use several types in different parts of the same plant. Incandescent lamps are usually made up as small units, but may be combined or grouped so as to form larger units.

The carbon incandescent lamp has a high specific consumption and is economical only with very low price of power, or in small portable units. As it will stand rougher handling than any of the other forms, the carbon lamp is ordinarily used with extension cords.

Tantalum lamps are finding a considerable use in manufacturing plants, especially where direct current is available.

The tungsten lamp has practically revolutionized commercial lighting and is now being extensively adopted in industrial lighting especially in textile mills. It is by far the most efficient of the incandescent class, and while the maintenance seems high in some cases, it is being rapidly reduced with the progress of development. Where lamps are protected from excessive vibration or shock, the tungsten is giving an exceedingly long burning life. In choos-

ing between tungsten and tantalum, the cost of current and the size of unit desired are usually determining factors. Tungstens lamps are used singly or in groups with metal diffusers or prism glass reflectors. Where there is considerable building vibration, they are provided with spring suspensions. In equipping and arranging lamps thought should be given to determining where the light is wanted and what degree of diffusion is required. Where there are dark ceilings, all upward light is wasted, as far as lighting the process is concerned.

Inclosed carbon arcs, both direct and alternating current, are used to a large extent in industrial lighting. They are efficient as large units and have a very low maintenance cost. For the higher grades of lighting they are often equipped with diffusers to soften the light and direct it downward at desirable angles.

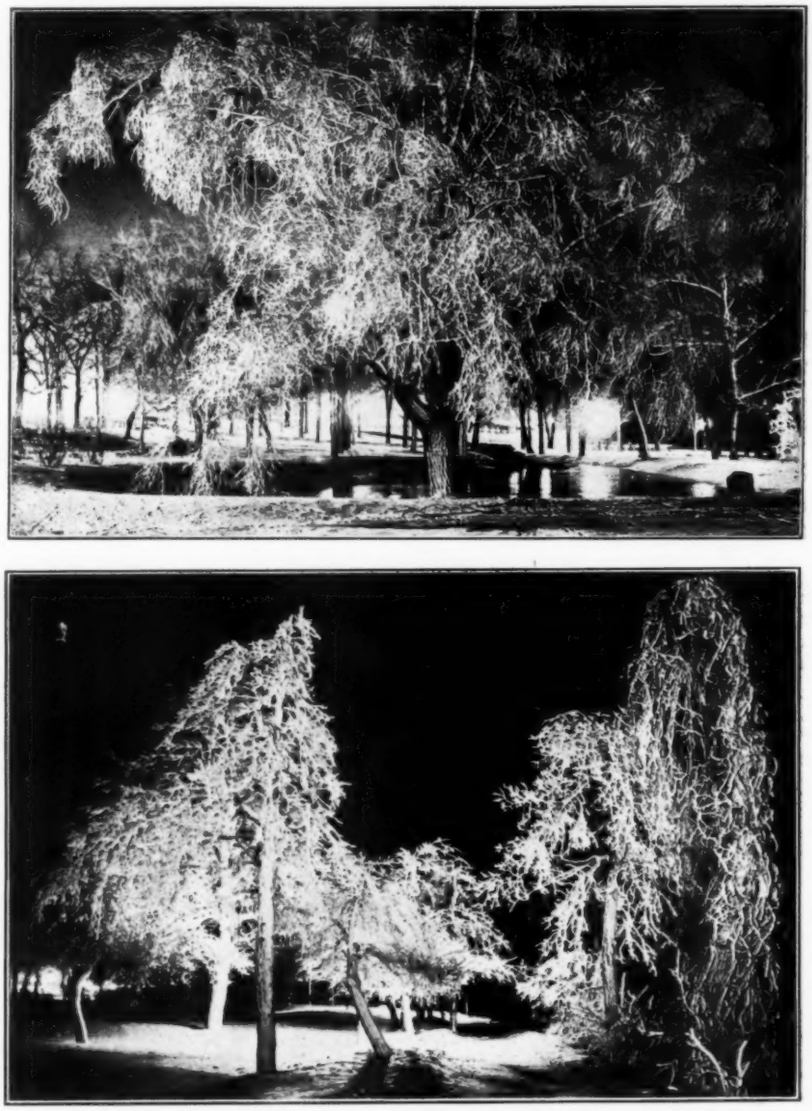
The intensified inclosed arc lamp is now available for direct-current multiple circuits. It is more efficient than the corresponding capacity of the inclosed arc lamp. This lamp and the high-current inclosed arc lamp are superior to all others of color selection.

The flaming arc lamp, using the so-called yellow carbons, after several years' use principally as an advertising light, is now being used to a considerable extent for the lighting of foundries, machine shops, etc., where the rooms are high, and where it is desirable to hang lamps above the cranes. The characteristic distribution of this lamp as now built is particularly adapted to high buildings since the maximum light is thrown directly downward. The light is very powerful, and suited for lighting large areas when hung high.

The remarkable developments of the last few years, and the remoteness of ideal efficiency, give promise of further development and improvement in illuminants. The importance of these developments in cheapening and at the same time improving the artificial illumination of industrial processes behooves the manufacturer to keep abreast of the times. It should be borne in mind that the first cost of almost every type of electric lamp is relatively small, as compared with the cost of a year's operation, so that the user can afford to take advantage of the developments, even to the extent of throwing out his old lamps and putting in new ones at reasonable intervals.

Electric Lighting of Prospect Park, Niagara Falls.

Every day reveals new advantages of electricity. A few years ago there was much gratification over the fact that the summer night beauty of the Falls of Niagara was portrayed in color under the influence and effects of powerful searchlights. The scene was one of magnificent splendor which fascinated thousands nightly Now, the scenic effect of Niagara in winter is to be enjoyed by electric light, a fact to which the beautiful views herewith reproduced bear witness.



ELECTRIC LIGHTING EFFECTS IN PROSPECT PARK, NIAGARA FALLS.

The scenes are in Prospect Park, where a short time ago the commissioners of the state reservation at Niagara Falls installed an electric lighting system. All through the park the lights are grouped on posts that stand nine feet high, the light distribution being quite effective, as the pictures show. The ice-clad trees pick up every ray of light about, while the darkness of the night sky forms an ideal background for the perfect portray of the spot where King Winter reigns in such magnificent form. Heretofore, the ice effects of the Niagara fairyland were visible only in the day time, but since the park has been so nicely lighted even the least of the beautiful ice creations can be seen by night. After a stormy day, with the tourists kept close in their hotels, it aids very materially in the enjoyment of a trip to be able to go out to the riverside at Niagara and there view the winter glory by electric light. The usual ice effects at

Niagara are developed by the spray cloud being wafted from the falls far back into the forest growth in the park and on the islands. There the tiny drops are frozen by the breath of winter, turning the dead, dark woods into a forest growth of what has the appearance of being purest marble. The transformation wrought within a few hours is wonderful in the extreme, and all visitors to Niagara welcome the possibilities of the night pleasures in winter as well as in summer. E.

Frosting, Etching and Coloring of Incandescent Lamps.

In the February number of the *National Electric Light Association Bulletin* the lamp committee of the Association submits the following information as the result of inquiries from member companies and believing that it will be of general interest:

Frosting Lamps.—Frosted lamps improve lighting results by giving better diffusion and more agreeable lighting. A properly frosted bulb cuts off comparatively little light, averaging from three per cent to seven per cent, or from one-half to one candlepower on a sixteen-candlepower lamp.

Lamp bulbs may be superficially frosted by dipping in a compound which any company can readily purchase from various manufacturers. This frosting is not permanent, however, nor as satisfactory as the etched frost given to the lamps by the manufacturers, which is effected either by sand blast or by acid. Both processes give very similar results, but for incandescent lamps the acid method is generally used.

The acid method employs a solution consisting of hydrofluoric acid and carbonate of ammonium thoroughly mixed in a proportion of about ten quarts of acid to eight pounds of carobnate. This is contained in a leaden vat large enough for the admission of a rack full of lamps. Placed alongside the acid tub is a rinsing vat. The lamps are inserted in rubber sockets in a wooden holding rack, and after an initial dip in the rinsing vat to clean them, they are immersed in the acid solution for about half a minute, and again washed in the rinsing tub. If extra heavy frosting is required, lamps may be re-dipped as many times as necessary. Where it is required to frost only a portion of the lamp, rubber hoods are placed over the lamps to a point where the frosting is to stop. The acid frost operation is dangerous and requires considerable experience in order to obtain successful results. Utmost care must be used in handling the hydrofluoric acid compounds, as not only will severe burns result if the solution comes in contact with the human skin, but the fumes are injurious to the eyes and respiratory organs. This work, therefore, should be done in a specially ventilated room, and the operator should be thoroughly protected by rubber gloves and apron.

Frosted lamps may be cleaned by dipping them in very hot water and rubbing them thoroughly dry with tissue paper. Where this is not sufficient, a little soap should be used with the hot water. Tungsten lamps should always be burning while being cleaned.

Etching Letters or Symbols on Lamps.—The acid etching of letters or symbols on lamps is not attended with the objections and difficulties of the complete frosting process, and can be readily employed by any company to mark its lamps permanently.

The question of identifying lamps as the company's property is a matter that has been given more or less attention—more particularly perhaps by the larger companies, in order to protect themselves against fraud and theft of lamps, especially since the advent of the metallized-filament and tungsten lamps, which are much more expensive than carbon-filament lamps.

A simple and comparatively inexpensive method, which may be used by the companies rather than by the manufacturer of lamps, is to etch the bulbs either with the name of the company, with a letter or with a symbol.

This etching is generally done on the bulb near the base, and by this means the lamp may be readily identified, as the etching is a permanent and positive mark which it is difficult to remove in any way.

It is undesirable to have the identification marks placed on lamps by the manufacturers, being necessarily expensive; and when so etched, the lamps become special and unsuitable for shipment to other than the one particular company. It is suggested, therefore, to the smaller companies, that should they meet with difficulty or loss in the theft of lamps, the following method of identification can be adopted with comparatively small attendant cost, to be used locally in their own stockroom or at any convenient point:

A rubber stamp, a solution of etching fluid and a heater with a perforated sheet-metal top are practically all the requisites necessary for this process. The heater is perforated in order that the heat may come in instant contact with the lamps and cause them to warm up quickly.

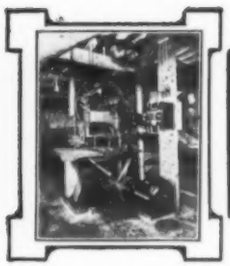
A tray full of lamps is placed in this heater with the operator on one side. In front of the operator are the stamps, a rubber pad and a small brush with which to spread the fluid on the pad. When the lamps become warm they are taken from the tray, stamped, and replaced as rapidly as possible. When they have attained a temperature of 150 degrees Fahrenheit, the tray is removed and the operation is finished.

The formula for the making of etching fluid is as follows:

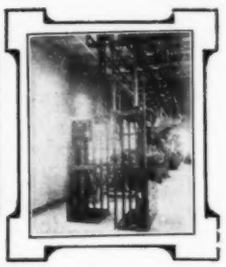
To one pound of ammonium fluoride crystals add thirteen ounces of fifty-two per cent hydrofluoric acid and eight ounces of water. Stir this solution occasionally and let it stand over night, when it should be strained. Then strain the clear part of the solution through medium coarse muslin. Care should be taken in the selection of the ammonium fluoride crystals, which should be of fairly large size. Sheet lead or hard rubber vessels should be used as containers for the etching fluid.

Coloring of Lamps.—Naturally colored lamps, of which the glass is permanently colored, are the only ones that are thoroughly weatherproof. As such lamps are rather expensive, superficially colored or dipped lamps are quite generally employed. Suitable coloring mixtures can be obtained from a number of manufacturers, and the lamps can be readily dipped by any operating company. In this work the old or dim lamps removed from the circuits may be used. The plan generally followed is to burn the lamp in a vertical position with tip down at about two-thirds or three-fourths of its normal candlepower. When the lamps have become slightly warm, take a cup of the dipping solution and raise it slowly until the lamp is submerged therein up to its base; then lower slowly, allowing the excess of liquid to drain off into the cup, and proceed to the next lamp. Lamps should be burned until the coating becomes thoroughly dry and firm.

Blue, green and purple are not desirable, as these colors absorb so much of the light that the lamps are hardly distinguishable at a distance.



Industrial Power



THE APPLICABILITY OF ELECTRICAL POWER TO INDUSTRIAL ESTABLISHMENTS.[1]

BY DUGALD C. JACKSON.

A great change has arisen in the attitude of mill and works' owners toward electrical power following the demonstration of certain of its qualities —especially those qualities which have contributed convenience in the arrangement of machinery so as to save floor space and to accelerate output, quicker speeds for machines or closer adaptation of speeds to the needs of high-grade manufacture, cleanliness in work rooms, and safety to employees.

Whenever water power is available, but not contiguous to the most convenient factory site, electrical power is essential to the highest success of a manufacturing project, because by it the power of the water may be conveniently and reliably delivered for use in the most effective manner at the most desirable site. The power of several waterfalls may in the same manner be converged upon a single factory site, which may either be contiguous to or distant from the stream providing the power. Even when water power in large quantities is available directly alongside suitable factory sites, the electrical distribution of the power may play a part of sufficient importance to enable it to supplant mechanical methods on account of its flexibility, which leaves the mill architect free to arrange his factory buildings to suit the requirements of manufacturing product, substantially untrammeled by those difficulties that always surround the transmission and distribution of power by mechanical means.

Also, in these days of perfected electrical power distribution for factory purposes, a multiplicity of boiler and engine rooms (or water-wheel rooms) located at various points on the premises has become not only unnecessary, but is recognized in most instances as wasteful. A single power house where electrical power is generated for distribution to all parts of the establishment provides a more convenient and economical arrangement. Steam-driven power houses of this character may be located on the most favorable part of the property for the receipt of coal and supplies and the disposal of ashes, and with a proper eye to prevent inconvenience in the manufacturing processes of generating steam power.

In a similar manner the old and ineffective plan of dividing water-wheels amongst several power houses along a canal, where large amounts of power are to be used in an establishment, and adapting the factory buildings to the locations of these power houses—a plan characteristic of many of the older textile mills of New England—may now be replaced by the much more effective arrangement with a single water-driven electric power-house located at the most advantageous hydraulic position on the canal. The factory buildings may then be grouped and arranged as best suits the requirements of economical manufacturing, without limitations caused by inflexible mechanical means for distributing the power. By the electrical distribution, the power may be put wherever it is needed with convenience, economy, cleanliness and safety, and to any amount needed.

Advantages are thus derived from both the manufacturing aspect and the aspect of power generation per se from utilizing electrical power distribution in connection with important industrial plants. Steel works, with their valuable by-product of gas-power from blast-furnace gases, make striking instances of the use of comprehensive, unitary, works' power - generating plants under conditions which formerly would have required at least several power plants scattered about the works. These are striking instances illustrating the present tendency, but many similar illustrations are to be found amongst the factories in nearly every important branch of industry.

The centering of power generation into a single generating plant for any large establishment is accompanied by economies in power generation that are of themselves appreciable, besides contributing to reliability. The question that I wish particularly to bring to your attention is: how far should such concentration proceed?

Without the electrical distribution of the power, such concentration could not be adequately carried out at all. Moreover, whatever limitations still exist toward improving the economy by completely concentrating the power generation in any industrial establishment, exist with respect to the prime movers and not with respect to the electrical distribution of the power. Where hydraulic prime movers are to be considered, the concentration may ordinarily be made as complete as the conditions of water supply will permit, since the charges on account of first cost of installation and the labor cost of operating practically dominate the cost of the power developed, and these may ordinarily be expected to decrease per unit of output as the capacity of the plant is increased, under conditions of equal or improved load factor.

An equivalent condition has not heretofore existed where steam prime movers have been used. Since neither labor cost nor steam economy are much improved by increasing a steam-electric generating plant over a size of a few thousand kilowatts capacity when reciprocating engines are used, the need of extreme concentration of individual plants has not heretofore been acutely felt. But the advent of large steam turbines has altered the conditions. Plants equipped with these machines installed in association with boilers provided with adequate labor-saving appliances may be operated with labor costs that vie with the labor costs pertaining to hydraulic generating plants equipped with machines of equal size; and the steam economies derived from the newer

[1] Abstract of a paper presented at a joint meeting of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, Boston, Mass., February 16, 1910.

steam turbines are remarkably satisfactory. I cannot here enter upon a discussion of steam-turbine economies and their influence on the generation of electrical power for manufacturing establishments; but my purpose is fulfilled by emphasizing the fact that the operating economies of large steam-turbine plants, either in respect to the use of labor or the use of fuel, do not seem to be exhausted within the limits of capacity yet attained in even the largest generating plants now in commission. Moreover, the first cost per kilowatt of capacity of plant, including land, buildings, and machinery, falls off in an important degree for the larger steam-turbine plants, until such a plant may nearly rival a hydroelectric plant in the gross cost per kilowatt-hour of energy delivered at the switchboard, through the fact that the fuel cost pertaining to the steam-turbine plant has an offset in the charges caused by larger first cost per kilowatt of capacity of hydraulic plant. Mr. Scott's curves illustrate this point clearly.

These considerations indicate that concentration of steam-electric generating plants will afford considerable economies when the concentration is carried much further than heretofore, provided large steam turbines are utilized as prime movers. The ultimate economy cannot be reached in a single factory plant, even when it comprises several thousand horsepower and logical development leads beyond the present practice of concentrating the power units of each manufacturing establishment in to an individual power plant. Economy and reliability in power service are both to be obtained by further concentrating such individual power plants located in a compact industrial center into one or more great central stations each of which provides power for a number of establishments.

The usual round estimate of the cost of power in machine-shops and the like is $60 per horsepower per year—taking the average power during working hours, perhaps nine hours a day on the average. The cost is probably fully that large, as the power in machine-shops seldom exceeds a couple of hundred horsepower and often does not exceed one hundred horsepower. The load factor is also rather low. Under more favorable conditions, large reductions may be made compared with this figure. In the case of a mill using an average of substantially 2000 horsepower for twenty-four hours per day, 313 days in the year, the cost per indicated horsepower per hour may be reduced to the following figures in case a compound condensing Corliss engine is used and the boiler firing is intelligently supervised. The cost of coal is put at $4 per ton on the cars at the purchaser's siding, and it is supposed to cost twenty five cents per ton of fuel to put the coal in the powerhouse bunkers and to dispose of the ashes.

Under the conditions referred to, the costs are substantially as follows, per indicated horsepower per hour in a well-run plant:

	Cents
Fuel, oil, waste and repairs	0.42
Labor	0.08
Insurance (boiler, liability and fire), interest (at eight per cent), depreciation and taxes on power plant including building and land	0.15
	0.65

This is based on horsepower measured by steam-engine indicators on the engine cylinders, and (on account of power losses and other expenses) the cost may be increased fifty per cent or more for the power mechanically delivered to the centers of use in the mill; in which case the cost would correspond to central station charge of as much as one and one-fourth cents per kilowatt-hour for electrical power delivered to motors of large size carefully located in the mill. When running the same plant ten hours per day instead of twenty-four, the cost would come to substantially one cent per indicated horsepower per hour, and when mechanically delivered to the centers of use, the cost of the power may reach a rate corresponding to a central-station charge of as much as two cents per kilowatt-hour. In small plants and plants with a less favorable load factor, the cost is ordinarily much higher; the illustration which I have taken relates to power generated under conditions particularly favoring a low cost per horsepower-hour for an individual industrial plant.

The mill using ten per cent more power at the maximum than is required on the average, and operating 313 days of twenty-four hours each in the year, gives substantially seventy-eight per cent annual load factor based on an installation of a rated capacity equal to the maximum load. If the ten per cent by which the maximum load exceeds the average is expected to be carried by the margin in the capacity of the machinery over regular rating, as it properly may be in cases where the extra load only occurs for brief periods when the mill is cold after having been shut down, or for some similar reason, the annual load factor of the machinery is substantially eighty-six per cent. With a load factor like this, a large turbine station can generate electrical power at a remarkably economical rate. It is three times the load factor ordinarily pertaining to electric lighting stations.

Putting this mill on a nine-hour régime for 313 days in the year, would bring its annual load factor down to little over thirty per cent and would increase the cost of the kilowatt-hour. The load factors of the run of manufacturing establishments rule less than this, as the power consumption is generally subject to more variations than in the mill that I have chosen for illustration.

Even with the conditions named in my illustration, a large properly designed and built turbine station delivering power to a considerable number of factories ought to be able to improve a little on the power costs and add something to reliability The requirements for heating mills and the use of steam in various manufacturing processes often make it impossible to remove the means for generating steam from the factory site, but the generation of steam for power purposes is commonly accomplished separately on account of the different pressures needed for the two purposes and the separation is therefore a matter to be dealt with as of manufacturing convenience rather than as controlled by economy of steam generation.

It therefore seems that we have before us a certain definite character of development in the power generation for our industrial cities Electrical distribution of power has made its way in factories of all kinds of product on account of its adaptability to diverse requirements; that is on account of what we commonly refer to as its flexibility. It has proved particularly advantageous on account of its ready adaptation to delivering power wherever and in whatever position the best interests of getting out product demands; on account of its joint properties of steadiness of speed and controllability of speed, which have contributed to increasing both the quantity and quality of product; on account of cleanliness, reliability and safety, which have also strongly commended its use. Its use

has also ordinarily proved economical from the standpoint of cost of horsepower applied to the machine shafts. The advantages of flexibility and speed control are being constantly widened by wiser designing of motors and their appurtenances, as experience extends. Economy and reliability are being additionally provided in the improved designs and more substantial construction of new power houses. But one of the important possibilities for densely crowded industrial cities is still almost untouched. For instance, in the city of Philadelphia many tens of thousands of horsepower are used for manufacturing in establishments crowded together in city blocks, and the power is developed in separate large and small power plants located, as physical conditions warrant, in each establishment and with a minimum consideration given to economy. Several (perhaps three) large steam-turbine electric power houses, located on tide water aside from the densely occupied areas and constructed with a careful eye to minimizing the cost of the kilowatt-hour, could profitably supply this power at figures corresponding with its existing cost, and at the same time release for productive purposes large parts of the very valuable space now occupied by individual factory power plants. This would also relieve the thickly occupied parts of the city from the smoke and dirt that have become seriously objectionable, and would also remove the inconveniences now relating to providing the fuel supply and discarding the refuse.

Copper Exports.

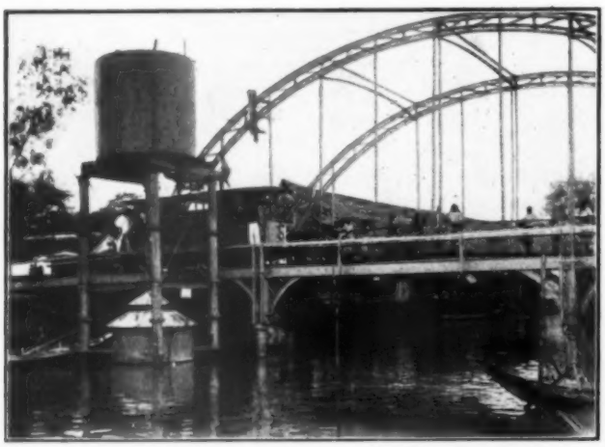
Exports of copper for the week ending February 11 totaled 9,411 tons. Since the first of the month, 14,743 tons.

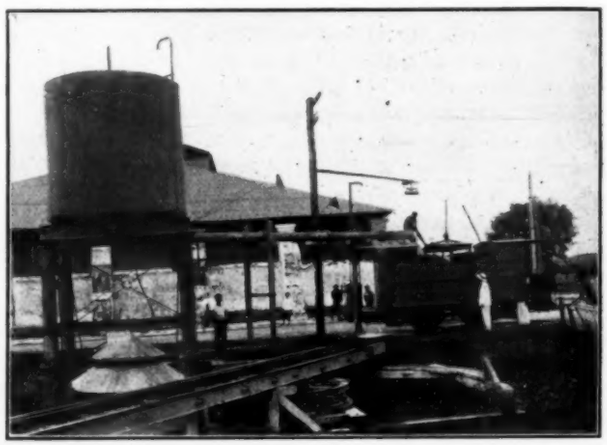
ELECTRICALLY DRIVEN PUMPS.—VIII.

AN AMERICAN INSTALLATION IN SIAM.

An interesting example of American industry and trade aggressiveness occurs in far-off Bangkok, the enterprising capital of Siam. This city has a comparatively up-to-date central station which is operated by the Siam Electricity Company, Limited (W. F. Jacobsen, chief engineer; L. Diemer-Hansen, electrician). The generating equipment has a capacity of 2,300 kilowatts. Current is generated at a voltage of 2,000 (two-wire system, single phase, 100 cycles). For lighting and power purposes this is stepped down to 100 volts, and, for the street-railway system, to 550 volts.

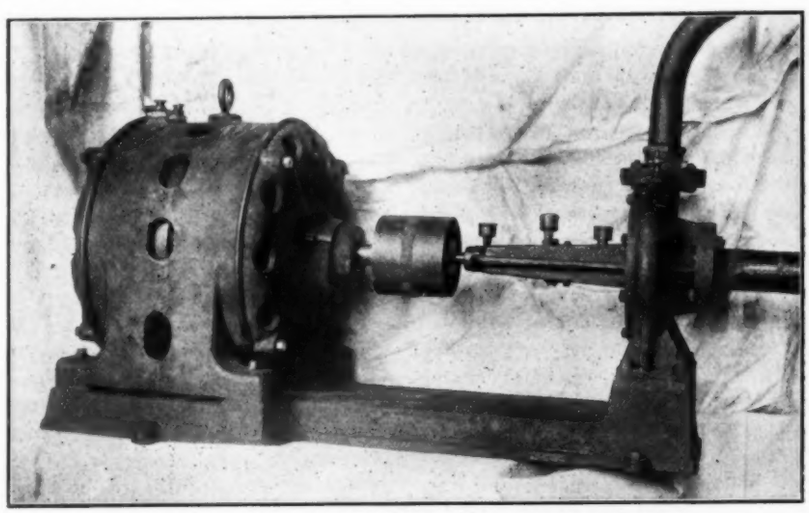
Recently the Siam Electricity Company has installed a very unique electrical pumping outfit, a large part of which was purchased from prominent electrical firms in this country. This outfit includes light motor-driven, direct-connected, centrifugal pumps, of brass, made by The Gould Company, of Chicago, Ill. Each pump is mounted on an iron sub-base and connected through a flexible coupling to a five-horsepower "Century" single-phase, self-starting motor (wound for 100 cycles, 100-200 volts), manufactured by the Century Electric Company, of St. Louis, Mo. A view of the pump and motor is shown in one of the accompanying illustrations.





VIEWS OF THE FIXED AND FLOATING TANKS.

The pumps are designed for handling, under normal conditions, thirty-five tons of salt water per minute under a thirty-foot head.

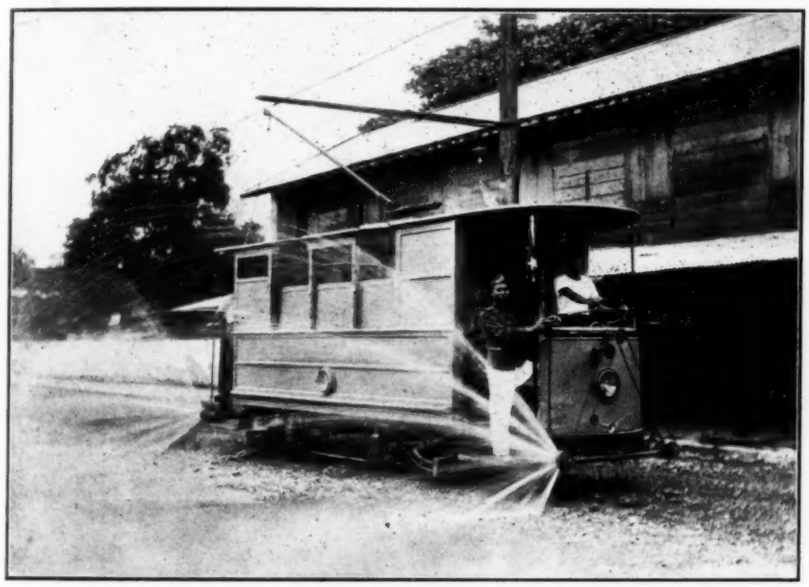


GOULD PUMP DIRECT-CONNECTED TO "CENTURY" MOTOR.

Each equipment is mounted in a floating tank and pumps water into a stationary tank which is located immediately above the floating tank. The delivery pipe is fixed to the floating

tank and adjusted in such a way that the head is always the same, either at ebb or spring tide. Each equipment is automatically controlled by two float switches and a P-M remote-control switch manufactured by the Price- McKinlock Company, of Boston, Mass. The two float switches are used so as to control the starting and stopping of the pumps, according to the water level in the tank, and to stop the motor if the suction pipe gets into sand, which is the case at low tide.

The water pumped by these equipments is used for street sprinkling and for fire purposes. The street sprinkler shown in the accompanying illustrations is fitted with an A. E. G. 500-volt, direct-current motor and two centrifugal pumps. The pumps are used in series for fire-extinguishing purposes, and in parallel for street sprinkling.



THE STREET SPRINKLER.

(To be continued.)

The Ekaterinoslav Exhibition.

An exhibition of agricultural, manufacturing and home industries will be held at Ekaterinoslav, Southern Russia, from July 14 to October 8, of this year, and Prince Ouroussof, president of the exhibition association, has extended a special invitation to Americans to participate therein.

The division which should particularly attract American exhibitors, says Consul-General John H. Snodgrass, of Moscow, in a recent consular report, is that of agricultural implements and machinery.

LOW MOTOR SPEEDS BY MOTOR-GENERATOR DRIVE.—I.

PRINTING PRESS MAKEREADY SPEEDS.

BY S. H. SHARPSTEEN.

In certain erecting shops an electric motor is required that will give a very low speed to drive the machine being erected. After the machine is erected a normal production speed is also required that will permit of a test of the production capabilities. Resistance in circuit with the armature, to get the low speed, is very satisfactory in most cases.

Fig. 1 illustrates a plan of using one large motor for the main drive, and one small motor generator to furnish a low-voltage current for the armature of the large motor when only a very low speed is required. The smaller machine could be conveniently erected on the top of the larger one, or the two machines could be fastened on one base as convenience might demand. The two machines with their starters, if placed on a truck, would be portable to make it possible to take the drive to any point on the erecting floor or part of the factory or shop.

In Fig. 1, A is the armature of (say) a ten-horsepower motor. When only production speed is desired the double-throw service switch SS would be placed in the switch jaws P and P^1, the fields F and F^1 at once being excited by current passing through the field wire SF, attached to the line L^3 at Z^2, the field coils on the magnets F and F^1, and the field wire SF^1 attached to the other leg of the line L^2 and Z^3. For the sake of simplicity the field wiring is done independently of the starter or controller C and is closed as soon as the switch is placed into the jaws P and P^1.

The armature current would pass through the wire AC attached to the line L^2 and Z, the brush B^1 armature A, brush B, wire AC^1, the starter C, wire AC^2, connected to the leg L^3 of the circuit at Z^1. This part is simple and would reuire only a standard starter.

If a certain uniform very low speed were required, the double-throw service switch SS would be placed in the jaws P^2 and P^3, when the fields of the ten-horsepower motor would be excited at once by field wire SF being connected to

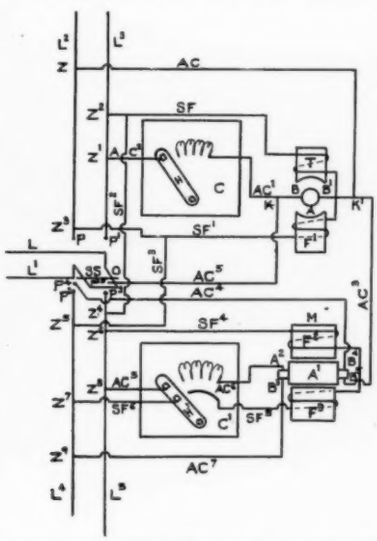


FIG. 1.—MOTOR-GENERATOR MOTOR DRIVE.

the line through SF^2 *at* Z^4, and field wire SF^1 connected to the opposite line at Z^5 by means of SF^3.

The fields of the motor-generator M would be excited by means of current passing through the field wire SF^4, being connected to the line L^5 at Z^6, field coils on magnets F^2 and F^3, field wire SF^5, starter C^1, and field wire SF^6 connected to the line L^4, at Z^7.

The armature line current to drive the motor-generator M would pass through armature wire AC^5, connected to the line L^5 at Z^8, starter C^1, wire AC^6, brush B^2, one winding on armature A^1, brush B^3, armature wire AC^7, to line at Z^9. When properly running it would in turn furnish the predetermined low-voltage current for the armature A through the wire AC^4, and AC^5 passing around through the switch jaws P^4 and P^5, and being

connected to the wire AC^1 at K, the brush B^4, one winding of the armature A^1, the brush B^5, wire AC^3, back to AC at K^1. The starter C being held to the off position by the usual spring, and L^2 and L^3 being dead, the armature A could get only the low-voltage current and would furnish torque for low speed.

Having but one service switch, and that a double-throw one, makes it almost impossible to have line current, and motor-generator current on armature A at the same time.

The switch jaws P^4 and P^5 with the auxiliary blade O are necessary to open the low-voltage circuit when the switch is thrown for production speed. If there is not required any armature resistance for speed control in either case, both starters, C and C^1, can be quite small and placed on the top of the large machine in conjunction with the small machine.

One of the good features of this plan is the absence of gears, pinions, belts, and ratchets between the small machine and the large motor or the driven machine.

As the amount of energy passing through either of the windings on armature A is small, one armature-speed controller at C^1 in place of a starter would permit of varying the low voltage at the brushes of armature A and furnishing a small range of speed control at the armature A.

If the motor-generator M had two sets of fields and two armatures, a field rheostat inserted in the field circuit of the motor end would give a considerable range of quite constant voltage at the generator end, provided the motor-generator were properly designed and constructed with the purpose in view.

The very low speed would be about one-twenty-fifth of the maximum or normal speed of the motor. As the torque required to drive machinery usually decreases as the speed, it would seem that the low-voltage current capacity of the machine could be very small, but this will not hold true in practice as the power required to start almost all kinds of shafting and machines is much in excess of what it takes to keep them running slowly after once moving.

If a ten-horsepower motor were to be installed to drive shafting or almost any piece of machinery, an auxiliary machine of one kilowatt would be pretty close to the proper size to use, and one kilowatt, ten-hour-run rating, forty degrees temperature rise for the combined windings of the motor-generator. The motor-generator should stand one hundred per cent overload for starting and very short runs, making the capacity of the generator or low-voltage windings of the motor-generator, for such purposes, one kilowatt.

There are cases, as in pumping under certain abnormal conditions, where this would not apply.

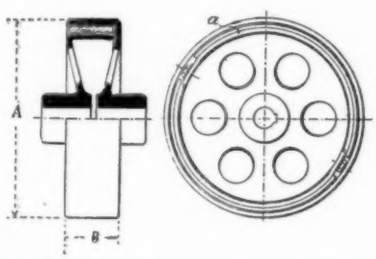
This method of getting a practically constant very low speed applies particularly to printing presses. The old way of getting a low press speed for flat-bed or cylinder presses, was by armature control, which is very unsatisfactory. If an equipment be made up with the motor-generator placed on one side or the top of the main motor drive, a very low press speed, for ink spreading, making ready, and doing repairs can be obtained without armature-resistance control. One electric manufacturing company did make up some web-press drive and control equipments on this plan, but seemingly never pushed the system to a completed state. It is now in use in the printing room of the New York *Sun*. The New York *Herald* has two equipments of this kind in use and there are others in Philadelphia.

Theoretically this system is ideal. The writer has investigated some of the installations now operating and there is no apparent reason why it should not also be excellent practically.

(To be continued.)

Coupling-Sleeve for Motors with Closed-Circuit Armature.

The polyphase motor with closed-circuit armature might be designated as an ideal machine, if it were not for the difficulty of starting it under load. In order to overcome this drawback and permit the motor to be started practically without load, friction couplings have been designed, which operate under the action of centrifugal force when the machine has reached a certain speed. The coupling must not act before an angular velocity corresponding to the maximum torque has been nearly maintained. It is necessary, therefore, to employ a given weight for the part subjected to the action of centrifugal force, and this weight must not be exceeded, for otherwise the coupling will operate too soon. When the coupling does take place, on the other hand, there must be no slip between the two parts of the mechanism, and for this reason it is necessary that the weight of the pieces obeying the action of centrifugal force be increased. These considerations have led Fischer-Hinnen to design a coupling in which the pressure increases more quickly than the angular velocity. It is illustrated in its simplest form in the accompanying figure. The rotation of the outer disc of the coupling, fastened to the shaft of the motor, is transmitted to the inner disc by means of two belts attached to the outer periphery of the inner discs at two diametrically opposite points. By



THE FISCHER-HINNEN COUPLING.

the action of centrifugal force these belts are pressed against the inner surface of the outer disc and take it along by friction. If the motor has a high speed the weight of the belt causes sufficient friction; if the speed is low, the action of centrifugal force is increased by placing a sheet of lead or iron between two belts. The air between the belts and the surfaces with which they are in contact is gradually forced out, so that the pressure exerted by centrifugal force is increased by the much greater atmospheric pressure, and the slip between the two parts of the coupling, under normal conditions, is less than 0.2 to 0.3 per cent. The device is being manufactured by the Oerlikon Company in five types for speeds varying from 800 to 3,000 revolutions per minute.—*Translated and abstratcted from L'Industrie Electrique (Paris).*

Power Scheme in Belgium.

A recent dispatch from Brussels states that electrical works to cost about $2,400,000 may shortly be erected in Belgium for the purpose of distributing electric power to the manufacturing interests in Luxemburg. It is proposed to dam the River Sure, near Boulaide, for this purpose. An investigation into the possibilities of the scheme is being prosecuted at the instance of several Belgian banks and Luxemburg manufacturers.

BILLBOARD LIGHTING.—What would be the best and least expensive way to light up a billboard 100 by twelve feet in size and mounted thirty feet from the ground? This board is surrounded by others and the light is to be confined to it only. Could a person use reflectors with twenty-five or sixty-watt lamps burning in a vertical position? Is there any electrical book published which shows how to wire up and get various effects in spectacular signs?—J. T. O., St. Louis, Mo.

The billboard may be very satisfactorily lighted by means of flaming arc lamps equipped with metal reflectors. Each lamp takes ten amperes at fifty-five volts or two may be put in series on a 110-volt line. With these reflectors about three lamps would be required for a board of this size. These lamps may also be equipped with prismatic reflectors which throw the light more to the sides; with this type of reflector two lamps will be found sufficient, which, operating two in series on a 110-volt line, will require 1,100 watts. Flame arc lamps should be placed eight or ten feet in front of the board and about level with, or a little above, its top. Tungsten lamps may be used of sixty-watt or 100-watt size with metal reflectors which throw the light downward and to one side. These lamps should be placed about five or six feet in front of the billboard and on a level with its upper edge. Allow about two watts per square foot, or in this case, 2,400 watts to obtain an illumination comparable with that from the flame arc lamps. There is no book treating this particular branch of illumination.

ELECTRICAL ENGINEERING SOCIETIES.—Does the American Institute of Electrical Engineers take into membership persons not resident in the United States? Is there a society in England corresponding to the American Institute?—A. B. C., Vancouver, B. C.

The American Institute of Electrical Engineers takes non-residents of the United States into membership, in fact, it has quite a few foreign members. Headquarters of the American Institute of Electrical Engineers are at 33 West Thirty-Ninth Street, New York, N. Y.; its secretary is Ralph W. Pope. In England there is the Institution of Electrical Engineers, whose headquarters are at 92 Victoria Street, London, S. W., England. The secretary is P. F. Rowell. The Institution of Electrical Engineers was founded in 1871 and has members in all parts of the world, particularly in the British possessions.

AUTOTRANSFORMERS.—What is the difference between an autotransformer and a regular transformer?—A. D. H., Two Harbors, Minn.

The regular transformer has two electrically independent coils interlinked around a magnetic circuit. The primary coil receives current from the supply circuit and the secondary coil delivers current to the receiving circuit. In the autotransformer the primary and secondary circuits are electrically connected, one being a tap on the other. The distinction is clearly shown by Figs. 1 and 2. Just as a regular transformer

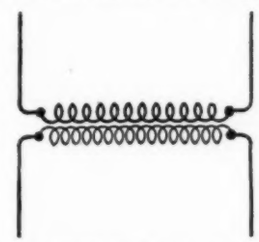


FIG. 1.—REGULAR TRANSFORMER.

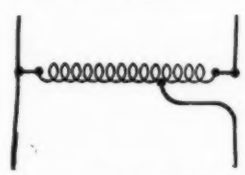


FIG. 2.—AUTOTRANSFORMER.

may step-up or step-down the voltage of the primary, so an autotransformer may be used to boost or reduce the voltage of the primary or supply circuit. In Fig. 2, if the upper circuit is the primary, the autotransformer is used as a depressor, that is, to reduce the voltage. Autotransformers are used commonly for starting induction motors, for sign, or other low-voltage incandescent lamps, for moving-picture projectors, etc. They are sometimes called compensators. Autotransformers are very compact and highly efficient, particularly when used for relatively small voltage changes.

DISCHARGE TO GROUND—What causes a current to flow if only one side of a metallic circuit is connected to ground? Is this caused by lack of proper insulation at the power station, or would this flow take place even if the line as well as the generator are perfectly insulated and only one side of the line is grounded?—W. C., Nashville, Tenn.

If a circuit is perfectly insulated throughout its length a connection at one point only to ground should not cause any flow of current to ground unless there is present on the circuit a steady charge superposed upon the potential prevailing therein due to the source of electromotive force within it. It is very common for overhead circuits to be charged by atmospheric causes. This gives them a potential different from that of the ground. A connection between the circuit and ground, therefore, causes an equalization of charges, or a discharge as it is commonly called. This discharge becomes more pronounced the greater the perfection of the line insulation. If the insulation along some portion of the circuit is defective, then a ground upon another part of the circuit will establish a leakage path through the defective spot and the ground.

POLYPHASE MOTOR ON DIRECT CURRENT.—Will a sixty-cycle polyphase 220-volt motor run on a 220-volt direct-current circuit and give satisfaction?—B. E. M., Seattle, Wash.

A polyphase motor, whether two-phase or three-phase and regardless of its voltage and frequency, can not be run on any direct-current circuit.

MOTOR-GENERATOR SET—In the query relative to the lack of capacity in a motor-generator set submitted by J. B. S., of Buffalo, in the issue of January 1, an unfortunate typographical error in the answer has been discovered. The set was one of ten kilowatts capacity and the direct-current generator was a 250-volt machine. The currents for this machine were given as 400 and 200 amperes, instead of forty and twenty-five.

BOOK REVIEWS.

"The Design and Construction of Internal-Combustion Engines." By Hugo Guldner. Translated by H. Diederichs. D. Van Nostrand Company, New York, N. Y. Cloth, 672 pages (8 by 11 inches). Illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $10.00.

This book is a complete and comprehensive treatise on the internal-combustion engine, written by a gas-engine designer and builder for others engaged in the same work, with an idea of presenting to the technical man and especially to the gas-engine designer a reliable handbook, and to the gas-engine builder new in the field a practically useful guide. Concerning the scope and manner of treatment of the material entering into the various departments, the book may be divided into five parts. The first part consists of a critical discussion of the most important of the older types of internal-combustion engines to serve both as an introduction to the field in general, and to give a brief résumé concerning constructions already tried and in part abandoned. The second part treats first of the thermodynamics of the gas engine in a form and to an extent which the real purpose of the book seems to justify. This is followed by a critical examination of the various events of the gas engine cycles, a subject which should be welcomed alike by the designer and the practical man. The most extensive part of the book, however, the one which brings out most clearly the real aim of the work, is the third part, intended to serve as an every-day working guide to the designer and constructor. While the third part shows the method of designing the various separately mentioned parts, it is the main purpose of the fourth part to show how these various parts are utilized in combination in the modern types of internal-combustion engines, and to give some information concerning the field of application, erection, etc., in various forms. The fifth part treating of the gas-engine fuels and combustion in the gas engine, is also mainly arranged to suit the needs of the designer, but there is little doubt that the practical man will also find many things of service to him. In order that the designer and builder not familiar with thermodynamics may find it entirely useful, a brief treatise of Thermodynamics and Thermochemistry is given in the appendix to avoid complicating the main part of the book with elementary discussions. The rest of the subject matter of the appendix is a miscellaneous collection of information on several topics which will prove of interest and value.

"Fowler's Electrical Engineer's Pocket Book." By William H. Fowler. Scientific Publishing Co., Manchester, Eng. 574 pages, (3¾ by 6 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This issue of the tenth annual edition of this pocket book for electrical engineers has again been made the subject of careful revision, with a view to keeping the matter up-to-date and abreast with current practice. Each branch of the electrical industry has been dealt with in as much detail as space permits and a number of the chapters have been completely rewritten and revised. More tables and formulas have been added, making the work a complete and valuable hand books for electricians and electrical engineers.

"The Alternating Current Commutator Motor and the Leakage of Induction Motors." By Rudolf Goldschmidt. D. Van Nostrand Company, New York, N. Y. Cloth, 212 pages (5¼ by 8½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $3.00.

When some years ago the single-phase motor with commutator made its appearance and its practical importance was proved by successful designs, the attention of inventors was directed to this class of machines. A great many new types were introduced so that it was possible to follow and to distinguish between "improvement" and "new principle." This chaos led to the preparation of this book in which the author attempts to clear matters by classifying the various machines and improvements. This classification has been effected by showing that there are actually only two different principles: Direct-current machines made suitable for alternating current by laminating the field, inserting resistance between the armature and commutator, by compensating armature reaction, and by providing commutating poles wound in a special way; and repulsion motors. The quality of alternating-current energy, that it can be transmitted from one circuit to another without electrical connection, has been made use of by "inducing" the current in the armature instead of "conducting" it there. These two principles are considered under the following heads: The series commutator motor; the Thomson repulsion motor; the repulsion motor of Latour-Winter-Eichberg; and special types. There is also a chapter devoted to examples and performances of commutator motors. This book is specially suited for engineers who have a thorough knowledge of direct-current machines and the principles of alternating current machines.

"The Leakage of Induction Motors" has been attached to the above work and contains many tables and curves which should prove valuable to designers of induction motors.

"The Corrosion of Iron and Steel." By Alfred Sang. McGraw-Hill Book Company, New York, N. Y. Cloth, 141 pages (5¼ by 7½ inches). Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The corrosion of iron and steel, which is a leading question among engineers, metallurgists and manufacturers, has been considered at length in this treatise, which is based on a paper read before the Engineers' Society of Western Pennsylvania, at Pittsburg, December 15, 1908. The work is in great measure a compilation and a study of actual tests and results and should prove valuable as a reference.

"Technical Press Index." Technical Literature Company, New York, N. Y. Cloth, 374 pages (7¼ by 10¼ inches. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $3.00.

This volume consists of a compilation in cumulative form, rearranged, reclassified and cross-indexed, of the items which have appeared monthly in the Technical Press Index section of the Engineering Digest during the eighteen months from January, 1908, to June, 1909, inclusive. It gives a key to over 11,000 articles of permanent value, and it is believed that these include every important paper and article published in the regular engineering periodicals of the United States, Canada and Europe, and in the proceedings of the various engineering and technical societies during that period. The typographical and physical arrangement is such as to render the search for an article dealing with any particular subject easy, and the whole classification is separated into a number of broad divisions. Under each technical division there are numerous subdivisions, which, with the cross-indexing, made the volume of immediate value to anyone interested in technical literature.

Mme. Curie Obtains Polonium.

Mme. Curie, who with her husband, the late Professor Curie, discovered radium, is said to have been successful in obtaining a tenth of a milligramme of pollonium, a new radio-active element which is 5,000 times rarer than radium.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

BROOKLYN, QUEENS COUNTY & SUBURBAN.

The New York Public Service Commission has issued a report covering operations for the year ended June 30, 1909, as follows:

Operating revenue	$1,344,836
Operating expenses and taxes	1,018,872
Operating income	$325,964
Other income	47,908
Total income	$373,872
Fixed charges	413,973
Net corporate loss	$ 40,101
Previous surplus	863,360
Total surplus	$823,259
Profit and loss debit	28,653
Surplus, June 30, 1909	$794,606

MILWAUKEE ELECTRIC RAILWAY AND LIGHT.

The Milwaukee Electric Railway and Light Company, including the Milwaukee Light, Heat and Traction Company, the Milwaukee Central Heating Company, the Racine Gas Light Company, Kenosha Gas and Electric Company and the Watertown Gas and Electric Company, has reported earnings for the year ended December 31, 1909, compared as follows:

	1909	1908
Gross revenue	$5,709,946	$5,462,582
Operating expenses, taxes & reserves	3,680,420	*2,354,877
Net revenue	$2,029,526	$3,107,705
Interest charges	1,257,974	1,524,288
Balance	$ 771,552	$1,583,417
Preferred dividends	270,000	270,000
Balance	$ 501,552	$1,313,417
Common dividends	315,000	890,000
Surplus	$ 186,552	$ 423,417

*Taxes and reserves included in charges in 1908.

INTERBOROUGH RAPID TRANSIT.

The New York Public Service Commission has issued a report covering both the elevated and subway divisions of the Interborough Rapid Transit Company for the quarter ended September 30, 1909, compared as follows:

	1909	1908
Total operating revenue	$6,296,567	$5,507,316
Operating expenses and taxes	2,990,270	3,073,373
Operating income	$3,306,297	$2,433,979
Other income	131,312	246,842
Total income	$3,437,609	$2,686,821
Interest, rentals, etc.	2,649,981	2,589,632
Net corporate surplus	$ 787,628	$ 91,189

DETROIT UNITED RAILWAYS.

Following the annual meeting of the Detroit United Railways, the directors of the company authorized the expenditure of about $500,000 for new equipment, which will include seventy-five pay-as-you-enter cars and seventeen interurban cars. Another $100,000 will be spent at the company's shops in Detroit in finishing the cars. Delivery will begin in April. At the meeting no action was taken relative to dividend resumption. Retiring directors were reelected and there was no change in officers.

The report of the Detroit United Railway Company for the month of December and twelve months ended December 31 compares as follows:

	1909	1908
December gross	$ 696,164	$ 606,065
Expenses	427,941	*376,534
December net	$ 268,223	$ 229,531
Other income	12,700	7,039
Total income	$ 280,923	$ 236,570
Charges and taxes	156,729	133,606
December surplus	$ 124,194	$ 102,964
Twelve months' gross	8,047,554	7,114,760
Expenses	5,042,724	*4,559,123
Twelve months' net	$3,004,830	$2,555,637
Other income	144,834	64,956
Total income	$3,149,664	$2,620,593
Charges	1,880,129	1,618,665
Twelve months' surplus	$1,269,535	$1,001,928

* Includes taxes.

WASHINGTON WATER POWER.

The Washington Water Power Company, of Spokane, Wash., has issued its annual report for the year ended December 31, 1909. The income account compares as follows

	1909	1908
Gross	$2,788,742	$2,454,585
Expenses and taxes	1,503,895	1,343,232
Net	$1,284,847	$1,111,353
Charges, depreciation, etc.	609,811	530,923
Surplus	* $675,036	$ 580,430
Dividends	442,424	351,141
Surplus	$ 232,612	$ 229,289
Previous surplus	874,150	644,861
Total surplus	$1,106,762	$ 874,150
†Adj. debit	246,263	.....
Power and light surplus	$ 860,499	$ 874,150

*Equal to 9.34 per cent on $7,233,200 outstanding capital stock.

†Interest, discount, and expense on account of pre-payment of $3,000,000 coupon notes; also premium paid for exchange of $1,313,000 collateral trust bonds for first refunding bonds; also 1-30 of discount on $4,000,000 first refunding bonds, due 1939.

Comparative statistics of the company's operations compare as follows:

	1909	1908	1907	1906
Enc arc lamps	2,462	2,675	2,346	2,043
H.P. of motors in Spokane	9,880	8,506	6,863	5,097
H.P. on transmission lines	16,652	14,176	10,569	5,905
Meters in use	15,502	12,843	10,503	8,060
Miles of track	101	97	96	83
Pass. car'd.	21,842,767	19,520,942	17,249,527	13,915,570
Car miles run	3,624,586	3,393,479	3,111,563	2,914,502

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of January compares as follows:

	1910	1909
January gross	$885,781	$829,036
Expenses	596,144	544,752
January net	$289,638	$284,284
Charges	233,787	235,568
January surplus	$ 55,851	$ 48,716

Twin City Rapid Transit Company.

It is shown in the annual report of the Twin City Rapid Transit Company for the fiscal year ended December 31, 1909, that the gross revenue increased $570,266, or 8.91 per cent, and net $441,695, or 13.66 per cent. The balance available for the common stock is equal to 9.94 per cent on the $21,100,000 outstanding as compared with 8.27 per cent in the previous year.

The income account for the year with comparisons is as follows

	1909.	Increase.
Operating revenue	$6,969,776	$570,266
Operating expenses	3,294,627	128,571
Net revenue	$3,675,149	$441,695
Interest and taxes	1,466,527	107,164
Balance for dividends	$2,208,622	$334,631
Preferred dividends	210,000	.....
Balance for common	$1,998,622	$334,531
Common dividends	1,055,230	50,250
Balance	$ 943,372	$284,281
Renewals	703,000	159,000
Surplus	$ 240,372	$125,281

In his report to stockholders President C. G. Goodrich says. "The property has been maintained in the same state of efficiency as heretofore. The amounts charged in this account for actual maintenance aggregated $423,499, an increase of $26,823 over the corresponding charge of last year. In addition there was charged for renewals, and charged against the renewal funds, the sum of $304,850. To this fund has been added, on account of depreciation during the year, as shown above, the sum of $703,000 and interest on the invested renewal funds, amounting to $50,050. The renewal fund at the close of the year aggregates $1,621,914, of which $1,173,500 is invested in the five per cent consolidated bonds of the company."

The report states that the insurance fund was increased during the year by $27,220, making a total now in the fund of $134,467. Of this amount $107,000 is invested in five per cent consolidated bonds of the company and the balance is in cash ready for investment. An appropriation from surplus of $100,000 was made to the contingent reserve fund, to which there was charged during the year $65,488. Expenditures for new construction during twelve months amounted to $846,112.

There was no change during the year in the amount of bonds outstanding, except that $20,000 of seven per cent first mortgage bonds of the Minneapolis Street Railway Company were redeemed on May 1, 1909. There was no change in the company's outstanding capitalization.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Motor-Driven Punch Presses.

The old dark punch-shop, with its lines of overhead shafts and belts, has disappeared from the modern factory with the advent of individual motor drive. As its sucessor, there has been left a clean, well-lighted apartment, free from ceiling obstructions, and having each machine separately driven by its own self-contained motor.

One of the most important operating results of this change has been the reduction in running costs. In order to operate a single machine, it no longer becomes necessary to incur the transmission and friction losses of the whole shop. Each press is started and controlled from the switch and rheostat mounted on its frame or in a nearby position. The mechanical connection from the motor to the crank shaft is made directly and efficiently by spur or chain gearing, giving a suitable speed reduction with a minimum number of parts.

Acompanying are photographs showing several of a number of motor-driven stamping presses for making metal boxes, installed in the modern factory of the Eclipse Box Manufacturing Company, Grand Rapids, Mich. Fig. 1 shows a large, seventy-two-inch double crank, back-geared press, built specially by the Toledo Machine and Tool Company for this installation. This machine is driven by a ten-horsepower, 250-volt, Westinghouse type S direct-current motor, running at 1,225 revolutions per minute.

The press is used for perforating, shearing, blanking and forming the various steel parts, such as angles, corner braces, sides, bottoms and covers, etc., of metal and steel-bound wood packing cases.

Fig. 2 shows a Toledo open-back, inclinable, plain press, used for making handles, lock parts, scutcheons, corner reinforcements and other similar parts of metal boxes. This machine is driven by a two and three-quarter-horsepower, 250-volt Westinghouse type S direct-current shunt motor which runs at 1,025 revolutions per minute. Line switch and starting rheostat are shown mounted directly on the machine frame. The large spur-gear reduction, meshing with the motor pinion, transmits directly to the crank shaft which carries the pitman connecting to the cross-head punch motion.

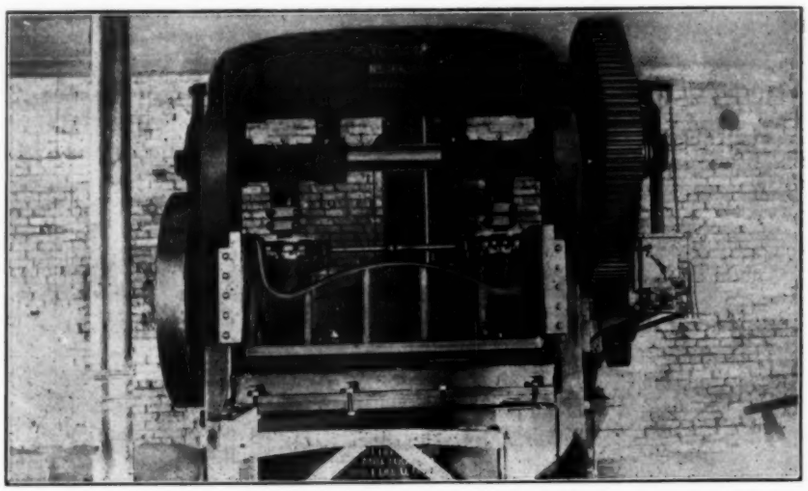


FIG. 1.—STAMPING PRESS FOR METAL BOXES.

Fig. 3 shows a Toledo deep-gap press used for riveting steel frames for metal-bound wood boxes, and for riveting together the steel parts for all metal or metal-bound wooden boxes. The drive is by means of a two-horsepower, 250-volt Westinghouse type S motor, running at 775 revolutions per minute, and geared to the shaft from which the punch eccentric is operated.

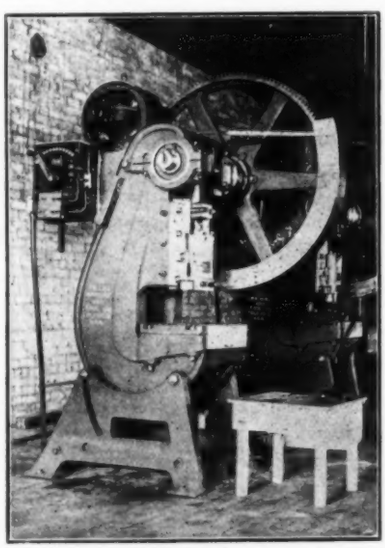


FIG. 2.—MOTOR-DRIVEN OPEN-BACK PRESS.

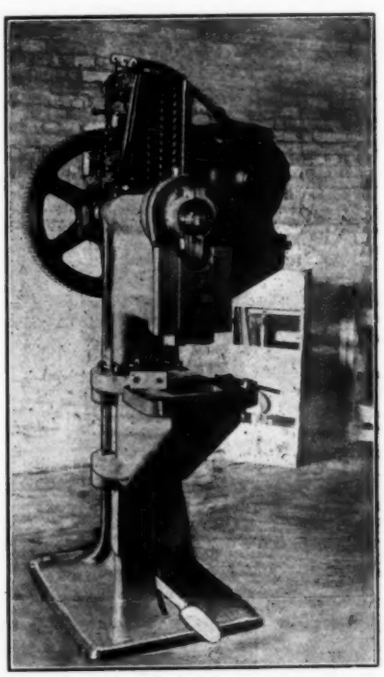


FIG. 3.—MOTOR-DRIVEN DEEP-GAP PRESS.

The demand for individually-driven presses has been growing for several years, and at the present time the manufacturer is furnishing a greater number of machines fitted with this modern form of electrical operation than ever

before. The growing scarcity of wood for packing cases has forced shippers into an increasing use of steel boxes. The industry thus started is destined to develop shortly into a very great business, which will include the manufacture of all kinds of containers for which wood is now used.

Wheeler Mazda Adjustable Window Reflector.

With the introduction of the higher efficiency metal filament incandescent lamps a radical change has been made in the method of show-window lighting, and the Wheeler Reflector Company, of Boston, through its experience of over thirty years in this branch of engineering, was able to give an early expression to its appreciation of the needs of this class of construction by designing its No. 65 Mazda adjustable show-window reflector, which has been meeting with exceptional success.

WHEELER WINDOW REFLECTOR.

The frailty of the filaments in the early tungsten lamps required their suspension in a pendent position and the above reflector was arranged so that the lamp would be held fixed in a vertical position while the hinged holder supporting the reflector permitted its adjustment at any angle to suit periodic changes of window trimming. Although the later Mazda lamps are more rugged and can be placed in any position, the vertical has been found to better preserve them from the accidents of jar and vibration and a maximum of efficiency can be obtained where the light from one side of the lamp is permitted to radiate in a useful direction without interception, and the light radiating upwards and from the side next to the street is diverted to a serviceable direction towards the bottom and back of the window.

The especial value of the adjustable feature will be recognized by those who have occasion to drape life-sized figures standing well back from the glass at one trimming and at the next to display shoes and similar goods at the front of the window, or perhaps make a display requiring light both at the floor in front and on the back wall. These reflectors are individual units and may be adjusted individually to produce the best effect.

Hawthorn Mazdaliers.

A complete line of lighting fixtures known as "mazdaliers" has recently been placed on the market by the Western Electric Company. These fixtures are designed in two styles, a stem type and a close ceiling type. The stem type, as shown in the accompanying illustrations, is intended for all classes of service where ceilings are ten feet high or over. The close ceiling type

HAWTHORN MAZDALIER.

HAWTHORN MAZDALIER.

is intended for ceilings less than ten feet and where clusters are preferred rather than light units.

A special feature in the construction of the mazdalier, which adds to the life of the lamps, is the method of suspending the lamp socket. The life of the mazda filament depends largely upon the conditions under which it is burned and the method of support. If properly supported and protected from jars and vibrations the life of the lamp is greatly increased. It will be noted that the suspension of the lamp in the mazdalier is made through a series of links, so that any vibration which is transmitted to the fixture is broken before it reaches the lamp.

The fixtures are adapted to practical illumination and furnished in standard finishes of brush brass and nickel. The standard arrangement of fixtures is in one, two, three, four and five lights, provided with Holophane reflectors. The standard spread of two and three light fixtures is fifteen inches, four light twenty inches, and five light twenty-five inches. The stems are based on a length of twenty-five inches over all from the top of the stem to the bottom of the reflector. Various spreads and various hanging lengths can, however, be furnished. The system of lengthening is standardized so that the fixtures can be used with any height of ceiling.

Chicago First Advertising Car.

One of the unique advertising features for Chicago's recent Electrical Show was an electrically illuminated street car, the first Chicago has ever had for exploitation purposes. It was put together in the shops of the Chicago City Railway and was operated over the South Side lines and the "through routes," covering the North and West sides from 4:30 to 10 o'clock P. M.

It attracted much attention as a brilliant advertising stunt. During the rush hours several nights the car stood on the Madison Street "spur" track, just off State Street, where it was seen by thousands of workers on their way home. The car was put together in twenty-four hours' time, otherwise more elaborate effects would have been employed. As it was this electric car looked like Halley's comet coming down the street.

Kellogg Switchboard and Supply Company Receives Patents and Models.

In a circular sent to the stockholders of the Kellogg Switchboard and Supply Company it is stated that the heirs of the Kellogg estate have presented gratis to that corporation all of the models, patents and apparatus created during the life of Milo G. Kellogg and used by the company. It is stated that the legal and experimental work represented in this gift cost Mr. Kellogg approximately $280,000.

The Goehst Insulation Cutter.

A new and novel wire cutting plier which, it is claimed, will greatly improve the present method of making wire joints, is being placed on the market by Mathias Klein & Sons, Chicago, Ill.

The Goehst insulation cutter, as this tool is called, according to the manufacturers, enables one wireman to take off as much insulation, in the same length of time, and do the work better than three wiremen working with jackknives.

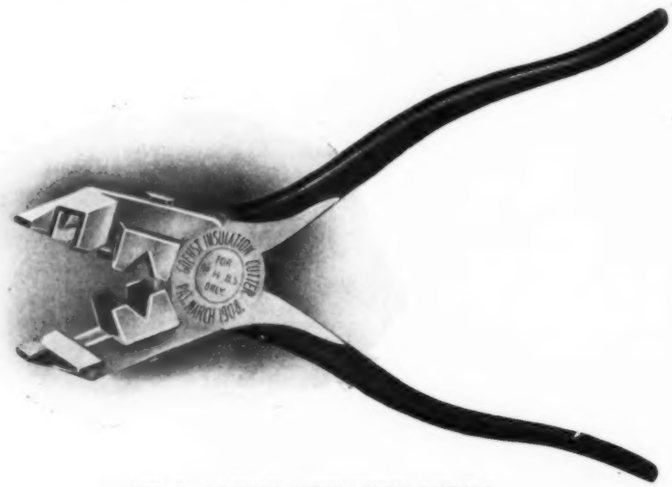


FIG. 1.—GOEHST INSULATION CUTTER.

A general idea of the construction and size of this device may be gained from Fig. 1, which shows clearly the Duplex slitting jaws, the wire cutting jaws and the insulation cutting jaws.

For cutting insulation for joints the wire is held in the V-shaped cutters, the the jaws are then pressed together firmly and the insulation will be found to be cut as shown in Fig. 2. The insulation is then pressed off with the flat nose of the pliers as shown in Fig. 3.

FIG. 2.—CUTTING INSULATION FOR JOINTS.

The method of slitting Duplex wire is shown clearly in Fig. 4. By inserting the jaws in the wire and drawing the pliers toward the operator, the wire is cut rapidly and clean, leaving the two strands perfect with the braid removed.

Train Dispatching by Telephone on Southern Railroads.

The Georgia Railroad will install within the next few weeks telephone equipment for dispatching trains between Augusta and Atlanta, Ga., a distance of 171 miles, and from Camak to Macon, Ga., a distance of seventy-four miles. There will be twenty-eight regular stations and five siding telephones on the line from Augusta to Atlanta, and twenty regular stations from Camake to Macon. The Georgia installation is the first one in that section of the country.

Railroads in the South have recently been very active in adopting the telephone method of handling the movement of trains. The Southern Railroad has purchased from the Western Electric Company equipment for the installation of telephones and selectors on a portion of its line, and it is reported that the equipment of the other divisions on this road will soon follow.

The Chesapeake & Ohio has completed the installation of similar equipment on the Cincinnati Division and expects to have installed within a short time equipment for handling train movements by telephone on three of its other important divisions.

FIG. 3.—REMOVING INSULATION.

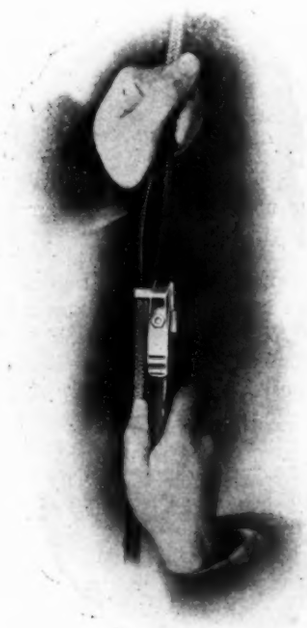


FIG. 4.—SLITTING DUPLEX WIRE.

The Norfolk & Western Railroad has equipped a large portion of its line with telephones, and plans to cover its entire system as soon as possible.

The Seaboard Air Line has installed the telephone on two of its divisions, and reports that the operations are successful.

Expansion of Connecticut Telephone and Electric Company.

The Connecticut Telephone and Electric Company, of Meriden, Conn., was organized in the spring of 1893 for the purpose of manufacturing long-distance and interior telephone equipment. Since that time, it has branched out very extensively into high-grade electrical specialties, among the latest being the famous Connecticut gas-engine ignition speialties for automobiles, motor boats, etc., which are now being handled by its sales representatives, the United Manufacturers, Broadway and Seventy-sixth Street, New York. Among these are the well-known Connecticut spark coils timers, distributors, switches, meters, terminals, etc., and the new Connecticut high-tension magneto, which has just entered the field. A new form of shock absorber will also be placed on the market this spring.

A new addition to the company's already large plant is now being constructed in the form of a brick building forty by 100 feet. This extra space is much needed and will be utilized for the general increase of the business. The Connecticut company still retains a large department which is devoted exclusively to its telephone apparatus.

BUILDING OF THE CONNECTICUT TELEPHONE AND ELECTRIC CO.

Tube Merger in London.

A plan of amalgamation has recently been agreed upon by the shareholders of the three principal London tube railway companies. About half of the stock of these companies is held in America, hence the amalgamation is a subject of considerable interest.

A New Prepayment Meter.

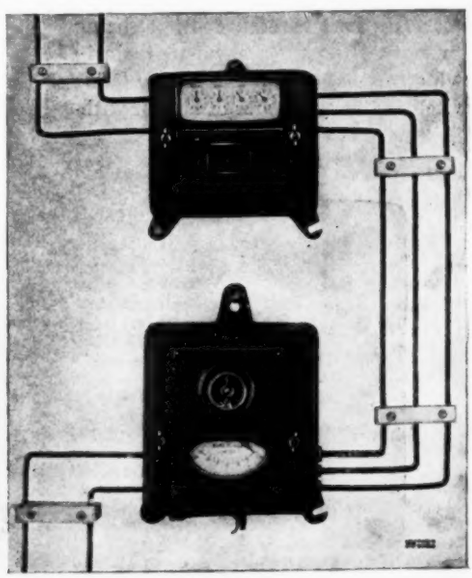
To many householders the "pay-as-you-go" method of meeting expenses is much preferable to the monthly bill system, with its attendant bother. To persons of limited means, monthly payments are often a hardship. Each of these classes offers a broad field for the sale of electric current, and to enable the central station to make a more effective campaign for this business, new prepayment attachments for use with either direct or alternating current Thomson watt-hour meters have recently been perfected by the General Electric Company. Aside from the advantages stated above, prepayment meters often act as a safeguard of the supply company's interests, for this device is an absolute protection against loss from unpaid bills and saves the expense of keeping a consumer's account, sending bills, and the several steps which must be taken before payments can be collected from some consumers.

When it is desired to make an advance payment the winding knob is turned so that the arrow points upward. A quarter-dollar is then inserted in the slot and the knob turned to the right, the coin serving as a key which operates the mechanism within the device, turning the registering wheel and placing the coin to the credit of the consumer. If the circuit is open when the coin is deposited, the same motion of the knob which moves the registering mechanism closes the circuit switch contained within the case of the attachment.

Whenever energy to the value of one coin has been delivered through the meter, the escapement is released (mechanically in the combined device, and electrically in the separate device) turning the pointer back one division. This process continues until all the energy for which prepayment has been made has been delivered. Thus the depositor can ascertain at any time how much energy can be obtained without further prepayment.

When all the energy has been delivered, the circuit switch is opened and no more current can be obtained until further prepayment has been made.

The indicating mechanism shows only the number of coins which stand to the credit of the customer; but by consulting the meter dial one can determine what fractional part remains of the prepayment next to be canceled.



GENERAL ELECTRIC PREPAYMENT METER AND WATT-HOUR METER.

The actuating force which operates the device is a large flat coil spring enclosed in a barrel or drum to which its outside end is attached. The operating knob winds this main spring by turning the drum. The spring has many turns and as the operation of the device never equals one whole turn, the spring always exerts a practically constant force.

The rate device consists of a small train of gears secured to the front of the frame directly back of the register, the gear ratio depending upon the price charged for the service. Each device is marked with the price per kilowatt-

hour for which it should be used. It will be noted that this device is a separate member secured independently to the meter frame so that it can be easily removed and replaced by the electric lighting company in case the rate of charge is changed. The meter can be adaped to any rate of charge from five to twenty cents per kilowatt-hour in steps of one-half cent.

The switch is of the double-pole, double-break type with leaf contracts, the construction being similar to that used in heavy current circuit breakers. The toggle joint used to close the switch arms against the terminal blocks makes it impossible for the switch to open through accidental jar and also prevents any back pressure from being transmitted to the escapement train in such a way as to retard its action. The switch is liberally rated and will with-

GENERAL ELECTRIC PREPAYMENT METER.

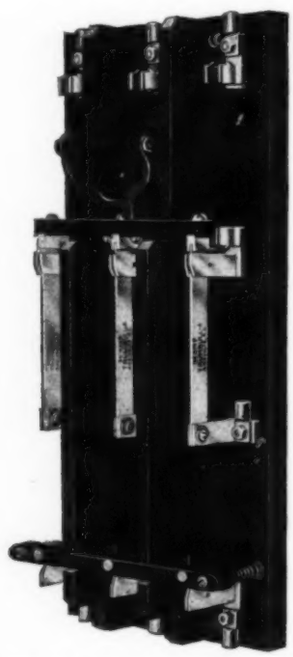
out injury to itself open any circuit carrying current up to the maximum overload allowable for the largest meter with which the device can be used.

The standard prepayment device is designed for use with quarter-dollars. The coin receptacles are placed at the back of the meters so that the covers may be removed without interfering with the receptacle in any way. This feature permits the meter to be tested without affording access to the coin box, besides, the collector, who is usually unfamiliar with the electrical features of the meter, cannot inadvertently injure its adjustment. The coin falls into a drawer which is removable from the bottom of the case and which can be secured by either a seal or any suitable padlock. The slot in which the coin is inserted is situated at the top of the meter case near the back.

Trumbull Alternating-Current Motor-Starting Switch.

The starting current of an alternating-current induction motor is often practically three times the normal running current, so that if the controlling switch is fused to carry running current only, the fuses are apt to blow when the motor is started. A new alternating-current motor-starting switch has been designed by the Trumbull Electric Manufacturing Company, of Plainville, Conn., to meet this difficulty.

The motor is started by throwing the switch into the unfused contacts, the blades being held for a few seconds until the motor speeds up, when the switch is thrown over into the fused



TRUMBULL MOTOR-STARTING SWITCH.

end which carries the normal full-load running current.

At the unfused or starting end of the switch is a spring attachment which automatically throws the blades out of contact, thus obviating any danger of leaving the switch closed on the unfused end. All the thirty-ampere switches are made of sixty-ampere material but fused for thirty amperes, and similarly for the larger switches.

A special angle spade handle is used, which enables the switch to be thrown from the starting end without twisting the wrist, and it is so raised as to have a good clearance over the fuses. The switch is built in two styles, for 250 and 440-volt alternating-current work.

New Tungsten Fixtures.

Two new tungsten fixtures have recently been added to the Benjamin Electric Manufacturing Company's list for store, shop, and factory lighting. Besides being substantially constructed, both are inexpensive, and may be used with low-voltage street series lamps having small Edison base, thus taking

FIG. 1.—BENJAMIN TUNGSTEN FIXTURE.

advantage of this important recent factor in efficient incandescent lighting.

The fixture shown in cut Fig. 1 has a cluster body with enameled steel reflector plate, fifteen-inch stem of three-eighths-inch iron pipe and three-quarter-inch brass casing, eighteen-inch open reflector, five-inch by four-inch canopy, and crowfoot. Two, three and four-light fixtures will take 100-watt lamps.

The fixture shown in the seond illus-

FIG. 2.—BENJAMIN FIXTURE WITH SHOCK ABSORBER.

tration has a tungsten cluster, eighteen inches deeply hooded enameled steel reflector, twelve-inch stem of three-eighths iron pipe, and shock absorber. Two, three and four-light fixtures will take 100-watt lamps. Those contemplating factory, shop, or warehouse installations will find them espeially serviceable.

Both fixtures in question are made from two to five lights and may be furnished either in multiple or series.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, FEBRUARY 11.—Remarkable results have been attained on the single-phase railway in the south of London during the two months that have elapsed since its opening. The traffic has increased by no less than sixty-three per cent and as a matter of fact, the company has already regained the number of passengers lost owing to tramway competition prior to the electrification, and which it was the very object of the experiment to achieve. The company has now under consideration the question of applying this mode of electric traction to other non-paying lines. If this success is not momentary and turns out to be permanent, it is certain that single-phase traction will become popular; although no figures of working cost are yet available. At present the assumption is that good results can be obtained by electric traction per se; nevertheless it is noteworthy that it took the District and Metropolitan lines a very considerable period to make any increase in their traffic. How far the third rail system had anything to do with this is doubtful, yet the competitive conditions on these lines and on the South London line are much the same.

The courts have again this week been fully occupied with electrical cases, one of the most important being an action for infringing the Ilgner patent relating to the use of flywheel motor generator sets for driving reversing rolling mills electrically. The case has been taken by the owners of the Ilgner patent (Messrs. Siemers of Germany), against the Electric Construction Company in respect to an installation in the Midlands, which it is claimed —and is not denied—embodies the Ilgner principle. In defense it is urged that Ilgner, in his patent, has merely taken an already well known principle of speed control on the lines of the Ward Leonard system and added to that a flywheel, the latter being another principle already well known.

That the cultivation of good feeling between electric supply authorities and their large consumers especially, is not to be ignored, is shown by the development of this spirit in the provinces. Quite recently the Birmingham Corporation entertained their large power consumers at their second annual dinner, and this week the Lancashire Electric Power Company followed suit. Not a great deal in this direction is being done yet, but the idea is gaining ground and consumers' dinners will doubtless be a common feature in a few years' time.

A new system of electroplating was described before the Society of Arts this week. It merely consists of rubbing powders, by means of a damp rag or brush, on to the article to be coated. The formula for deposition of zinc is as follows: Zinc, fifteen parts by weight; ammonium sulphate, five parts; magnesium, one part; chalk, ten parts; soapstone, twenty-five parts. Powder for deposition of other metals vary only in the first constituent, the zinc being replaced by silver, nickel and so on. The new process depends upon a principle which the inventor calls self-excitation; i. e., upon the reaction which immediately ensues between the electropositive metal and the metallic salt, as soon as the addition of moisture converts the latter into an electrolyte. In this reaction, the electropositive metal constitutes the anode and the object treated the cathode, and as the powder contains a quantity of finely powdered electropositive metal, it makes innumerable contacts with the cathode surface, and acts as so many minute cathodes. These latter gradually dissolve and set up in the liquid little local circulations of electro currents. The circuits are so exceedingly small and near to each other that they cannot be separately observed, and the surface of the metal becomes the seat of innumerable concomitant voltaic and electrolytic actions. Thus the potential or stored-up energy of the elementary substances in the powder is converted into electric current, and as these currents leave the liquid they throw down from the metallic salt in solution a thick film on the cathode and it becomes plated over with a deposit. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., FEBRUARY 19.—It is announced that the Canadian Northern Railway Company will soon begin the construction of a commercial telegraph line from ocean to ocean across Canada, along the line of railway from Fort William, Ont., to Edmonton, and at other points in the different provinces where the roads are built.

The Central Canada Power Company, with headquarters in Montreal, proposes to construct and operate works for the production of electric and hydraulic power, to enter agreements with other concerns and purchase their powers, and to erect lines of wires and poles. The capital of the company is placed at $5,000,000.

The municipal electric light plant of the city of Ottawa had a surplus of $24,000 for the calendar year 1909. This is an increase of thirty per cent over the profit made by the civic plant in the year previous. The city will make a substantial reduction in the lighting rates and the Ottawa Electric Company will follow suit.

It is learned that $150,000,000 is the capital behind the promoters of the project to dam the St. Lawrence River, at Long Sault Rapids, and that the Pittsburg Reduction Company is the organization at the back of the gigantic scheme. The shipping and transportation interests of Montreal are strenuously opposed to the project. It is also pointed out that if the present plans are allowed to go through, it would be giving away to foreign capitalists an asset of this country that is simply of incalculable value without receiving any substantial advantage in return.

A contract has been signed between the British Columbia Electric Railway Company of Vancouver, and the John McDougal Caledonian Iron Works Company, by which the latter agrees to supply to the former the first of the 4,000 kilowatt units for the Jordan River power plant on Vancouver Island. This plant will have a capacity of four 4,000 kilowatt units when completed. The extensive machinery is all to be built in Montreal. It is expected that the big waterwheel and generators will be working by next August. It will consist of a 10,000 horsepower Doble impulse waterwheel, directly connected with a 4,000 kilowatt Allis-Chalmers Bullock generator, working at 400 revolutions per minute. It will be connected with the Jordan River Falls, on the west coast of the island, which have a head of 1,180 feet, and it will require 9,000 feet of pipe.

The Postmaster General of Canada and the Postmaster General of Great Britain will shortly be able to exchange messages by the Marconi trans-Atlantic service. Marconi is now at the wireless station at Morien, Cape Breton, N. S., perfecting arrangements. J. N. Greenshields, K. C., one of the directors of the Canadian company, leaves for England to make arrangements for the extension and inauguration of the new services in the Dominion. Mr. Marconi states that he expects to have his Glace Bay station open soon for commercial business for transmission across the Dominion. For the wireless messages to inland points, it has been decided to erect a station at Winnipeg, Man. The erection of a number of small stations, Mr. Marconi says, has been started in the West Indies. Two stations have been built in Brazil and will be used for transmission across the Amazon. Commercial business will soon be established in South Africa, of which R. N. Vyvyan, formerly of the Glace Bay station, is the resident manager. Stations are also being erected in Italy, Belgium and other European countries. Mr. Marconi will be in Cape Breton for about a month. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

WORK TO START ON SANTA ANA PLANT.—Work on a $600,000 power plant for the California Edison Company will begin this spring in Santa Ana canyon. The plant will be known as No. 3 and will be the largest operated by the company in this section. It will have a 7,000-kilowatt capacity or double what any one of the present plants have. The structure with the other extensoin work will amount to about $600,000. The house will be built above the company's headworks in what is known as Lost Man's canyon, or at the site of Slide Lake. It is proposed to divert the water in Fillaree flats and carry it to the power house, also to carry the water from Cork Screw falls, which will bring two lines into the plant.

POWER DEVELOPMENT ON THE MIAMI & ERIE CANAL.—The Maumee Rapids Electric Company, with an authorized capital stock of $350,000, has been incorporated by George W. Stevens, Charles S. Ashley, Grant Miller, Hugh W. Haslup and Elliott Norton. It is backed by eastern capital, and has acquired a power plant at Miami, where it will install new machinery, using water power from the canal. It has water rights at Maumee and Grand Rapids, O., and will build plants at these places giving about 10,000 horsepower. Under its state franchise it is able to get into the heart of Toledo along the canal bank. Propositions for city franchises were turned down by the council some time ago. It is thought that some arrangement will be made with the Central Heating and Lighting Company, which holds down-town franchises, to distribute the product of the new company to consumers. H.

WASHINGTON POWER PROJECTS.—The Commonwealth Power and Water Company has been incorporated in Spokane County by J. E. Burns, E. F. Waggoner, F. W. Dewart, L. H. Brown and Carl Ultes, Jr., of Spokane, to expend $5,000,000 in developing power on the Spokane, Columbia and Snake Rivers. This will be in connection with an extensive irrigation plant designed to supply

moisture for a large tract of land near this city, also providing light and power for a number of towns in the district. The Railway, Water and Power Company was also incorporated a short time ago with a capital of $2,000,000 by H. L. Moody, J. M. Drumheller and Alfred Coolidge, of Spokane, to develop 35,000 horsepower within thirty miles of Spokane. Mr. Moody, president of the company, will submit a proposition to the city council to sell 10,000 horsepower to the municipality at $14 a horsepower, or $6 less than the present price, the idea being to have the city supply it direct to the consumer at a slight profit. The Commonwealth company will not enter the local field, but will confine its energies to the tributary district.

TO DEVELOP 91,000 HORSEPOWER.—The Kennebec Development Company has made plans for the retention and utilization of some of the power now running to waste in the Kennebec River. Three dams are to be built at a probable expense of $9,000,000 and the 91,000 horsepower developed will be transmitted to all parts of Maine. President O. H. Briggs of the company is reported as saying: "The three dams will be constructed at Indian Pond, a short distance below Moosehead Lake's outlets, where the two outlets come together. Below the falls, at the outlet of this pond, this dam will stand, rising till the water will not only flood out the long stretch of quick water between the east outlet and Indian Pond, but this pond itself will be buried by 125 feet of water. Below this dam will be built another 123 feet high, its highest level just on a level with the tailings of the up-river dam, which in its turn will afford a reservoir for another enormous holding of water and double the capacity of 30,000 horsepower allowed us by the first dam. Still further down the river toward the Forks the third dam will be built, also rising to an elevation of 123 feet. Each of these three dams will create a horsepower of 30,000. The total of our reservoir system, as planned, will approximate 56,000 acres."

LIGHTING AND POWER.

(Special Correspondence.)

ELM CREEK, NEB.—This city will install an electric light plant in the spring. P.

ELGIN, TEX.—T. L. Deisch, of Helena, Ark., has secured a franchise for an electric light plant. P.

GILBERT, MINN.—Bonds for $15,000 for the completion of the light and water systems have been voted. C.

HAYWARDS, CAL.—Action on the Suburban Power and Light Company's franchise has been postponed. A.

McALLEN, TEX.—The McAllen Ice and Power Company has been incorporated with a capital stock of $15,000. P.

DAVENPORT, IOWA.—The Peoples Light Company has applied for a franchise to install an electric light plant. C.

ELDON, IOWA.—E. J. Moore has secured a survey of the Des Moines River with a view to the construction of a dam. C.

MITCHELL, NEB.—The Mitchell Alfalfa Milling and Light Company has recently been incorporated with a capital stock of $50,000. P.

FOREST GROVE, ORE.—The Mayor has been authorized to buy machinery for a plant to supply Forest Grove with electric lights. A.

GETTYSBURG, S. D.—The installation of an electric light plant is projected. R. B. Fisk, J. A. Lake and others are interested. C.

SEATTLE, WASH.—The bid of E. H. Rollins and Son, and A. B. Leach and Company for $200,000 lighting plant bonds, has been accepted. A.

SEATTLE, WASH.—C. H. Knapp and R. H. Walker, with a capital stock of $10,000, have incorporated the Columbia Electric Company. A.

ROCHESTER, MINN.—The Rochester Light, Heat and Power Company has succeeded to the business of the Rochester Light and Fuel Company. P.

EUREKA, CAL.—An application has been made by W. C. Elsemere, for 15,000 inches of the Jacoby Creek waters to be used for power and domestic purposes. A.

REDWOOD FALLS, MINN.—R. F. Wherland will organize the Wherland Electric Company to supply electric light from the Redwood Falls Light and Power plant to surrounding towns. C.

SEATTLE, WASH.—The plans for Stone and Webster for 1910, include a hydroelectric plant on the White Salmon River and thirty miles of interurban line between Bellingham and Mount Vernon, Washington. A.

SALEM, ORE.—An application has been made by W. K. Bworn, of San Benito, Cal., for 1,000 feet of the waters of the Klamath River. Mr. Bworn intends to install a $250,000 plant which will develop 20,545 horsepower. A.

BOULDER, COL.—The dam being built at Nedeland by the McArthur Brothers for the Columbia Power Company, will soon be ready to operate. The new dam will be the largest in Colorado and will cost about $600,000. A.

REDLANDS, CAL.—A new power plant for the Southern California Edison Company, will be built in Santa Ana canyon this spring or summer. The plant will have a capacity for 7,000 kilowatts and will cost about $600,000.

PORTLAND, ORE.—Seymour H. Bell has sold the holdings of the Coos Bay Gas and Electric Company to H. M. Byllesby, who owns the Tacoma Light Company and several other plants throughout Washington, Montana and Idaho. A.

NEW LONDON, CONN.—Fort Terry, on Plum Island, is to be equipped with a complete power plant and electric lighting system, which, if present plans are carried out will make this post one of the best lighted ones in the country.

KENNEWICK, WASH.—The Hanford Irrigation and Power Company is enlarging the main power canal at Priest Rapids. The company will resume the improvement work in Hanford, started last year, including a water and lighting system. A.

DRAIN, ORE.—The City Council has passed an ordinance providing for lighting the city with electricity. The Drain Electric Light and Power Company, under a contract for twenty years, will begin work within thirty days and finish in eight months. A.

GEORGETOWN, WASH.—The Seattle Lighting Company has purchased the property owned by the Hofius Steel and Equipment Company and will erect a sub-station and a two-story office building. South Park, Youngstown and Rainier Valley will be served from this point. A.

ST. CLAIR, MICH.—The St. Clair Electric Light and Waterworks Company is installing a Ridgway 250 horsepower tandem-compound, condensing engine. Belt drive will be used. The work of installation is being done under the direction of W. M. Barron, superintendent.

PRESCOTT, ARIZ.—The local electric plant has been shut down and the wires of the Prescott Electric Company have been connected with the system of the Arizona Power Company. A second generation unit of 3,000 horsepower, will be added to the capacity of the plant. A.

REDWOOD CITY, CAL.—The Sierra and San Francisco Power Company has bought a strip of land, 20 by 500 feet, belonging to the East San Mateo Land Company. The Sierra Power people will erect four towers of the high-tension line, which they are now constructing into San Francisco. A.

SPOKANE, WASH.—The Columbia River Reclamation Company has been organized to develop waterpower sites in central Washington. The new company, of which Robert E. Strahorn is head, has filed a request for considerable land near Priest Rapids, Idaho. The capital stock is about $100,000.

REXBURG, IDAHO.—A propositon has been made to the City Council regarding the formation of a company to develop electric power. Parties in Victor desire that Rexburg, St. Anthony and other towns join with them in the erection of a mutual plant that would furnish light and power for the entire district.

DAVENPORT, IA.—The Davenport Water Power Company has filed an amendment to its articles of incorporation increasing its capital stock from $10,000 to $25,000. The increase was made because the company found it had too small a working basis for the preliminary work, and the officers wanted to have more capital involved.

DEFIANCE, O.—The Valley Power Company, headed by Congressman T. T. Ansberry, and backed by Eastern capital, has asked the city council for a franchise in the streets to furnish power to manufacturers. The plan is to harness the Auglaize River, two miles south of the city, and generate electric power for local use, as an incentive to industrial plants to locate in the city. H.

PRESCOTT, ARIZ.—Connection has been made with the lines of the Arizona Power Company and this city is now lighted by a plant on the Verde River, a distance of fifty miles. The power company has thus far sold about 4,000 horse power in this county, the largest customer being the United Verde Copper Company at Jerome, which is using 1,500 horsepower and which has called for 600 more.

MANCHESTER, N. H.—The construction crew of the Manchester Traction, Light and Power Company, which is setting the poles to arrange for lighting the outskirts of the city by electricity, has now got 570 poles set out of the 900 that are to be set before this arrangement for lights is completed. Good progress is being made and everything will be in readiness by April 19, when the new contract is to go into effect.

BOYLSTON, MASS.—The contract to build the electric light plant for the town of Boylston has been awarded to the Delta Electric Light Company of Barton place, Worcester, the contract price being $13,379. Other bids received were: Coughlin Electrc Company, Worcester, $20,315; Fred Ley & Company, Springfield, $16,996; M. K. Kendall & Company, Boston, $16,890; Delta Electric Company, Worcester, $13,379.

PROVO, U.—Articles of incorporation of the Salem Electric Company, which will supply electric light and power to Salem, have been filed with the county clerk. The capital is $10,000, in shares of the par value of $25. The directors and officers are: Charles Hanks, president; Peter Johnson, vce-president; Lewis A. Hatch, secretary; James P. Christensen, treasurer; F. B. Davis, James Banks and Andrew Peterson, directors.

LOUISVILLE, KY.—The contract for the construction of a new power building at Eighth and Market Streets has been awarded to a Toledo firm. According to the terms, works is to begin on the structure at once and it is to be ready for occupancy by Novem-

ber 1. The building will cost in excess of $200,000 and the floors will be let to manufacturing concerns. Light, heat and power and all necessary conveniences are to be furnished by the owner of the building.

EL RENO, OKLA.—An electric power plant will be installed by the Canadian Mill and Elevator Company for the purpose of supplying current to operate the street railway in this city. The machinery for generating the electricty has been purchased and will be set as soon as it arrives. The street car lines are being operated at present with motor cars, but when new service is in operation the lines will be extended to all parts of the city and a number of new cars placed in commission.

HUDSON, O.—The voters of this village by a vote of 162 to 97 decided to avail themselves of the advantages offered by J. T. Ellsworth, a New York millionaire, and former resident of the village. He will donate a model electric lighting plant, waterworks and a sewage system, upon condition that the town stays "dry" for fifty years, paints its houses white with green blinds and roofs of red tile, grows hedges to replace the picket fence, and plants shade trees. The proposition was made two years ago, and the former decision was reaffirmed last week.

CHARLOTTE, N. C.—The Lexington cotton mills are all to be run by electricity from the Southern Power Company's lines. The Dacotah and one of the Wennonah mills are already connected, while the other Wennonah and the Nokomis mill will be ready soon. The question of the town buying the Southern Power current is discussed. A propositon will be made at the next meeting of the City Council by a Charlotte firm of engineers to take over the town's equipment, replace it with new and put the plant in readiness for receiving power from the Southern Power Company.

AMESBURY, PA.—The Amesbury Electric Light Company has petitioned the state board of gas and electric light commissioners for authority to issue 200 shares of additional stock which at par will net $20,000 and $20,000 of twenty-year three per cent bonds. These bonds are wanted for the purpose of refunding bonds about to mature, the security being a first mortgage on the property. The money is desired for the purpose of paying off a portion of the floating debt incurred in enlarging the company's plant and lines for further extension of both now contemplated by the management.

ALTOONA, PA.—The Edison and Citizens' electric light companies are soon to be merged in a compnay which will probably be known as the Central Penn Light, Heat and Power Company. The first public move to bring about the culmination of the merger came on Tuesday when Dana A. Pearson, of New York, the prime mover in the proceedings looking to the consolidation of the two companies, was made president of the Citizens' Electric Light, Heat and Power Company, and E. B. Greene, superintendent of the Edison Electric Illuminating Company, was made temporary superintendent of the Citizens' plant.

PATERSON, N. J.—Public Service Corporation has just entered into contracts with the Westinghouse Electric and Manufacturing Company and the General Electric Company for more than $500,000 worth of machinery for the generation and distribution of electricity. The new equipment will be apportioned to the various divisions of the company's system so that improvements will be made in all of them. The contracts will call for generating apparatus, capable of producing 15,000 kilowatts, and, as the old machines to be displaced have a capacity of only 2,000 kilowatts, the gain in service will be about 13,000 kilowatts, all of which will be available for lighting and railway business.

CHATTANOOGA, TENN.—Capitalists from Georgia, Florida and South Carolina have formed a corporation to develop the water power of Flint River, near Warwick, Ga. Dr. D. J. Zeigler, of Columbia, S. C., is president of the company, which proposes to construct a concrete dam across Flint River about 30 feet high. After the dam is completed the company will install a power plant for the purpose of furnishing electricity to the Georgia cities of Cordele, Americus, Fitzgerald, Oglethorpe, Montezuma, Vienna and other places. It is understood that the company will take over the power plants that already furnish the various cities with electricity, and will also furnish manufacturing plants in these cities with electricity. The industry wil involve the expenditure of at least $1,000,000.

ANDERSON, S. C.—The Interstate Power Company has given a $5,000,000 mortgage to the Carnegie Trust Company, of New York, and the trust mortgage is being recorded in Anderson. The Interstate Power Company will develop Middleton Shoals, on the Savannah River, and other waterpowers in South Carolina and Georgia. The capital stock is five millions, and C. Elmer Smith, who is president, is also largely interested in the Savannah River Power Company. While the stockholders of the Interstate Power Company are reticent as to their plans, it is reported that the company will develop certain water powers bought in recently by J. J. Fretwell and others, of Anderson, and that it will also take over other electrical properties and engage in a general power business. This is one of the several large developments of the present rapid exploitation and building of power and electric plants and electric lines in the Carolinas and Georgia, and this new company, it is anticipated, will become a leading factor in the electrical business of South Carolina and Georgia. L.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LOS ANGELES, CAL.—Actual work on the short line tunnel to Santa Monica will begin about July 1 of this year. A.

SAN FRANCISCO, CAL.—The proposed Vallejo and Northern Electric railroad will commence construction work in April. A.

VACAVILLE, CAL.—The Vallejo and Northern Railway Company has asked for a fifty-year franchise to run through this city.

PORTAGE, WIS.—The Chicago & Wisconsin Valley Railway Company has applied to the council for a franchise for a street railway. C.

SEATTLE, WASH.—The Sultan Railway and Power Company will this season construct an electric line from the Great Northern power plant site. A.

SANTA BARBARA, CAL.—A franchise has been granted for a car line on State and Sola streets to the Santa Barbara Consolidated Railway Company. A.

DES MOINES, IOWA.—Chas. B. Keyes has petitioned the council for a right-of-way for an interurban trolley line from Princeton, Missouri, to Ames, Iowa. C.

ABERDEEN, WASH.—The Grays Harbor Interurban Company has made application for a franchise to operate a trolley line on the roads of Chehalis County. A.

SPOKANE, WASH.—H. L. Moody, D. M. Drumheller and Alfred Coolidge have incorporated the Spokane Railway and Power Company, capitalized at $2,000,000.

SALT LAKE, UTAH.—The Utah Power Company has presented a petition for a franchise to run an electric line from American Fork to Drain, Sandy and Midvale.

LOS ANGELES, CAL.—The financing of the Ontario and San Antonio Heights railroad has been completed. The construction work will commence in May of this year. A.

SACRAMENTO, CAL.—Extensive work in the laying of new rails and the installing of the double-track system is contemplated this year by the Sacramento Electric, Gas and Railway Company.

BRYAN, TEX.—Work on the electric railway between the Oricultural and Mechanical College and the city is progressing rapidly. It is expected that the road will be in operation in a short time.

MUSCATINE, IA.—The Davenport-Muscatine Railway Company has been incorporated with a capital of $100,000 and the company is awaiting the action of Davenport as to franchise. The officers of the company are: President, Joseph F. Porter; vice-president Joe R. Lane; secretary and treasurer, H. E. Weeks.

YANKTON, S. D.—C. A. Magee, a wealthy electric line promoter of Pittsburg, states that he will begin work in March on a line from Yankton to Centerville, Freeman and Parkston, and, securing the Yankton-Norfolk line from Yuell & Graham, of Chicago, he will build a bridge here and extend the line into Kansas.

REDLANDS, CAL.—The Redlands-Yucaipa Land Company may abandon its plan to build an electric line connecting the valley with Redlands and turn over its right-of-way, surveys and work already completed, to Mr. Huntington who contemplates the extention of the Redlands Central Line of Citrus Ave. through Sand Canyon to the valley. A.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light and Power Company is to build a dam across the Cedar River, at Cedar Falls, Dunn County. The structure and the power house will cost about $300,000. About 8,000 horsepower will be developed. It is intended to have the plant in operation by the coming fall. M.

KALAMAZOO, MICH.—The Michigan United Railways is placing an order for railway equipment which will amount to about $158,000. The order will consist of sixty motors, twenty city cars, one interurban car and several trucks. The cars will be delivered equipped for immediate use and will probably be put into commission by next fall.

WILKESBARRE, PA.—A charter has been granted for the construction of a street railway between this city and Pittston. The capital is $100,000 and the incorporators are Dr. Thomas J. Connelly of Ashley, president; Joseph L. Dunn, E. J. Loughran, Henry DeMun, J. Francis Holz, Wilkes-Barre; Joseph H. Smith and John R. Williams, Edwardsville.

OREGON CITY, ORE.—The Portland Railway Light and Power Company has commenced the construction of an electric railway from West Oregon City to Oswego, a distance of four miles in order to handle the logging business of the Willamette Paper and Pulp Company, the Crown-Columbia Pulp and Paper Company and the Hawley Pulp and Paper Company. The road will be in operation in three months.

CHICAGO, ILL.—The North Shore Electric Company will increase its capital stock from $4,000,000 to $4,500,000 the coming May. The directors have decided to tap the territory northwest from Libertyville and west from Waukegan—a territory which promises to be very profitable. The company is controlled by the Commonwealth Edison interests.

CLARKSBURG, VA.—The Fairmont and Clarksburg Traction Company will build a trolley line from Clarksburg to Weston, a

distance of twenty miles, on which work is to be started in a short time. Rights of way will be taken up as soon as the route is determined. The line will pass through Mt. Clare, Lost Creek, Janelew and other populous territory.

WAPAKONETA, O.—The Minster & Loramie Railway Company, which has been incorporated with a capital stock of $100,000, will build an electric railway from Minster to Loramie, a distance of three miles, to connect with the Western Ohio Electric Railway at Minster, thus forming an extension south of what is known as the St. Mary's branch of the latter road.

FORT SMITH, ARK.—The Fort Smith Light and Traction Company has filed a certificate with the secretary of state to the effect that the company had voted a total increase of capital stock from $1,600,000 to $6,500,000. The increase affects both common and preferred stock, the former being increased from $950,000 to $1,500,000 and the latter from $650,000 to $5,000,000.

CRESTON, IA.—The directors of the Des Moines-Creston interurban, report that stock amounting to $65,000 has been sold, half enough to insure the building of the road. Officers have been elected as follows: President, R. Brown, Creston; first vice-president, Jerry Wilson, Adair County; second vice-president, M. Harrison, Madison County; secretary, A. A. Lynn, and treasurer, W. W. Walker.

BUTTE, MONT.—The proposed electric road between Butte and Helena has been successfully arranged, and work will begin in the spring. Final surveys are being completed. The chief object of the road is to provide cheap transportation facilities for the mines of the Corbin district, a good tonnage of ore being guaranteed from the Boston & Corbin, Robert Emmet, Corbin Copper, Blue Bird and Alta companies.

GUTHRIE, OKLA.—The Chickasha Street Railway Company has been chartered with $150,000 capital, and proposes to build an electric line in Chickasha and into parts of Grady county. The length of its proposed line is six miles, and the estimated cost $100,000. The directors are Charles F. Woodward and W. Raymond Emerson, of Wakefield, Mass.; Lawrence Martin, R. D. Welborne and W. P. Weston of Chickasha.

WAYCROSS, GA.—Mayor J. M. Cox and a special committee from the city council are in conference with Burdette Loomis, Sr., in reference to establishing a street railway here. The city engineer will make a plan of the streets, showing preliminary plan of proposed system. A franchise has already been granted to Mr. Loomis and associates, who have given large cash bond as a guarantee of good faith. B.

PHOENIXVILLE, PA.—Permission to run a trolley line through the State park at Valley Forge has been obtained by the Phoenixville, Valley Forge & Stratford Trolley Company and the work of surveying the new line will be begun. The problem of obtaining a right of way through the historic camp site was one of the gravest questions which the trolley promoters had to meet.

CENTERVILLE, S. D.—A proposition has been made to build an electric line through this city to Sioux City and Sioux Falls, the intermediate points being Elk Point, Centerville, Leeville and Worthing. Work will be started about March 10. C. A. McGee, of Parkston, S. D., who is at the head of the project, estimates the probable cost of construction at $15,000 per mile.

JACKSONVILLE, ILL.—A franchise has been granted to the Springfield and Jacksonville Electric Railway Company to construct a line through Morgan County. The company has thirty days in which to accept the provisions of the franchise. This completes the necessary rights that the company needs and work will commence at once to further the road, of which two miles has already been built out of Springfield. The promoters of the road say they will have it finished by the first of July.

TOLEDO, OHIO.—A resolution has been introduced into the Toledo City Council directing the city solicitor to prepare a franchise ordinance stating the terms under which the streets on which franchises of the Toledo Railways and Light Company will soon expire, shall be granted for street railway purposes to any corporation seeking the privilege. For several years the street railway problem has been the paramount issue of local campaigns, and it is thought the question will soon be solved. The present administration was elected on a three-cent fare platform. H.

DAVENPORT, IA.—The Davenport and Muscatine Railway Company has received permission to incorporate in Iowa for the purpose of building an electric railway between the two cities from which the road takes its name. The capital of the company is placed at $100,000 and the franchise covers a period of twenty years. It is expected that the road will be ready for operation in two years from date. The officers of the new company are as follows: President, J. F. Porter; vice-president, J. R. Lane; secretary and treasurer, H. E. Weeks.

RED BLUFF, CAL.—The Northern Electric Railway Company, now operating the system between Sacramento, Marysville, Oroville and Chico, has filed deeds by which it secures rights of way across Los Molinos Colony in this county, twelve miles below Red Bluff. The deeds are granted free on condition that the railroad be extended from Chico to Los Molinos before the end of 1910, and on to Red Bluff before the close of 1911. It is not supposed that the company will stop buildng at Los Molinos, and the completion of its road to Red Bluff this year is confidently expected, with an extension to Redding and Kennett next year.

ASBURY PARK, N. J.—Announcement was recently made by George Pittenger, president of the city board of trade, that plans were being made for the building of a $2,500,000 electric railroad between this city and Trenton. The body of wealthy men behind the project has been incorporated as a company, and the right to condemn all such property as they shall deem necessary in the construction of their line has been accorded them by the state authorities. This proposed road will run from here to Freehold through to Hightstown via Englishtown and Jamesburg, and from Hightstown to Trenton, via Allentown. Instead of the third rail system, as is generally used by electric train lines, the overhead wire system will be used.

TOLEDO, O.—Incorporation papers have been forwarded to the Secretary of State at Columbus, for the formation of the Toledo & Indiana Traction Company, which is to own and operate the Toledo & Indiana Railway which was recently purchased at receiver's sale here, by a committee representing the majority bondholders of the old concern, for something more than $1,050,000. The inital capital of the new company is $10,000, which will be increased later on. The company will be organized within a few days with the probable election of S. C. Schenck, of Toledo, as president. That the new company contemplates the extension of the present lines is shown by the careful wording of the articles, among which will probably be a line from Bryan to Montpelier, a distance of ten miles. H.

TOLEDO, O.—At a meeting of the board of directors of the Toledo Railways and Light Company, Barton Smith retired from the board and William B. Hale, of Chicago, was chosen his successor. Mr. Hale also succeeds Mr. Smith as chairman of the executive committee. Mr. Smith having been relieved from all his duties has left with his family for Europe, where he will remain for several weeks. A number of the most valuable franchises of the company expire within a short time, and there has yet been no satisfactory agreement as to their renewal. The City of Toledo is insisting upon three-cent fares, and the company announces its unalterable opposition to the plan. A proposition is said to be under consideration providing for two-and-a-half-cent fares in five-dollar lots, single fares to remain at five cents straight. The change in the directorate at this time was made for the purpose of securing closer harmony between the protective committees of the bondholders and stockholders of the company.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BASTROP, LA.—The Home Telephone Company has been given a franchise in this city. P.

TROY, MONT.—The Troy Telephone Company has been incorporated with a capital stock of $40,000. P.

TINTAH, MINN.—The Tintah Telephone Company has been incorporated with a capital stock of $10,000. P.

McCOOK, NEB.—The McCook Telephone Company has been incorporated with a capital stock of $10,000. P.

MARSHALL, MINN.—The Northwestern Telephone Exchange Company will make improvements to cost $23,000. P.

HUDSON, S. D.—The Riverside Rural Telephone Company has been incorporated with a capital stock of $5,000. P.

CEDARVALE, OKLA.—The New State Mutual Teelphone Company has been incorporated with a capital of $10,000. P.

MT. PLEASANT, S. D.—The Mt. Pleasant Telephone Company has been incorporated with a capital stock of $10,000. P.

MAYFLOWER, NEB.—The Kinkaiders Mutual Telephone Compay has been incorporated with a capital stock of $6,000. P.

MAYVILLE, WIS.—The Mayville Telephone Company has filed an amendment increasing its capital stock from $24,000 to $60,000.

BLOOMING PRAIRIE, MINN.—The Farmers and Merchants Telephone Company has recently been incorporated with a capital of $10,000. P.

OCONTO, WIS.—In the spring the Farmers' Telephone Company will extend its lines to Stiles, Pensaukee, Abrams and Little River. C.

DOUGLAS COUNTY, WASH.—W. A. Kaiser, L. J. Coonan and W. R. Ball, with a capital stock of $50,000, have incorporated the South Telephone Company. A.

ROLLA, N. D.—The county board granted a franchise to the Ox Creek Farmers Telephone Company and construction on the system will be started shortly. C.

VACAVILLE, CAL.—The Vaca Valley Telephone Company, with J. C. Uhl as president, has been organized to establish connections with the Sunset Corporation. A.

NAHALEM, ORE.—S. Schovell, Rudolph Zweifel and George R. McKimens, with a capital stock of $3,000, have incorporated the Nahalem Telephone and Telegraph Company. A.

PORTLAND, ORE.—The McCormick Lumber Company has closed a contract for the installation of wireless apparatus on the Steamers Yosemite, Yellowstone, Cascade and Shoshone. A.

FRESNO, CAL.—The Western Lumber Company has applied for the right of way for a telephone line from the old Kings River bridge at Reedley, about three miles west along the public highways. A.

HICKSVILLE, WASH.—G. G. Henderson, George O. Rhinehart, W. H. Thompson, E. S. Durham and W. E. Kapp, with a capital stock of $2,000, have incorporated the Wheeler Telephone Company. A.

FOSTORIA, O.—Automatic telephones have been installed by the Citizens Telephone Company, and are now in use in this city. The system was recently completed by J. H. Straugh, who had charge of the work. H.

CHICO, CAL.—Scott Hendricks is working on a project to incorporate a telephone company which will operate in Plumas, Lassen and Modoc Counties and connect at Oroville with the Pacific States telephone system. A.

SALISBURY, N. C.—The commissioners of Rowan county have granted a franchise to the Gold Hill, N. C., Telephone Company and to the Ebenezer Telephone Company to operate telephone exchanges. Much progress is being made in building telephone lines in Rowan and adjoining counties. L.

INDIANAPOLIS, IND.—The Long-Distance Telephone Manufacturing Company, of South Bend, has notified the secretary of state that the capital stock of the concern has been reduced from $100,000 to $50,000. Marion Campbell is president. S.

JEFFERSONVILLE, IND.—Governor Marshall has asked for a permanent injunction against the Cumberland Telephone Company prohibiting the company from furnishing patrons in the state with race information. The purpose is to prohibit pool room gambling. The Governor will ask for a receiver for the telephone company if it persists in violating the order. S.

WILMINGTON, DEL.—Stockholders of the Louisville (Ky.) Home Telephone Company, incorporated in this state, held their annual meeting a short time ago. The stockholders were represented by B. B. Veech, of Louisville, Ky., president of the United States Trust Company. Directors for the ensuing year were elected. They include Judge John M. Lassing, of Walton, Ky.

BOSTON, MASS.—Judge Colt of the United States Circuit Court has heard arguments on exceptions to the report of Everett W. Burdett, as master in the suit of the Western Union Telegraph Company vs. the American Bell Telephone Company, to compel the delivery to the complainant of certain shares of stock to which he claims to be entitled under an agreement executed November 10, 1879. This agreement relates to the use by the defendant of certain telephone instruments. Mr. Burdett also seeks to have the defendant account to the plaintiff for the dividends on said shares. The plaintiff claimed $5,873,292.42, and the master found for the plaintiff for $2,579,914.64. Both parties have excepted to certain rulings and findings of the master.

ELECTRICAL SECURITIES.

Financial confidence improved last week as reflected in the movement toward recovery in the stock market. There was a momentary interruption to the recovery, which had set in the week before, when the week opened, owing to the false reports which had been disseminated of what President Taft was going to say in his New York speech on Saturday preceding. Professional operators who had bought stocks because rumor had said that the President would say that the government's attitude toward corporations would be moderated, sold again hastily after reading the speech. The prompt rebound from the first sharp declines demonstrated that the timidity caused by the amenability of corporations to the law was losing its force as a speculative factor. The rebound in the stock market has brought with it a more cheerful feeling over the trade outlook and greater confidence that the lull in business was temporary.

At the annual meeting of the Bell Telephone Company of Pennsylvania, directors were re-elected.

At the annual meeting of the Twin City Rapid Transit Company, E. A. Ames and Sir Henry M. Pellatt, both of Toronto, were added to the board. Other directors were re-elected.

At the annual meeting of the Mackay Company the trustees were re-elected. The number was reduced from eight to seven by the death of Dumont Clarke, during the year. A total of 539,179 shares was voted of the outstanding 913,804 shares.

The persistent strength in Massachusetts Electric Company's stock, in the face of a generally weak market, is explained by the practical certainty which now exists that the $20,557,400 preferred will be placed upon a straight four per cent basis with the May declaration of the July semiannual dividend.

The annual meeting of the American Light and Traction Company will be held in Jersey City, March 21. Books close February 26 and reopen March 2. Proxies run to Alanson P. Lathrop, Marion McMillin, Charles W. Young and C. N. Jelliffe.

The Boston and Worcester Street Railway Company has petitioned the Massachusetts Railroad Commissioners for permission to issue 4,370 shares of additional capital stock of par value of $100. The proceeds are to be spent for the following purposes: 1,580 shares for payment of floating debts; 370 shares for payment of land damages in Framingham; 1,400 shares for permanent additions and 1,020 shares to provide for working capital.

Harvey Fisk & Sons are offering at par and interest $11,000,000 Hudson Company six per cent secured convertible notes payable February 1, 1913. This issue of notes, like the previous ones, is secured by deposit with the Guaranty Trust Company of 150 per cent of the face value of the notes of Hudson and Manhattan Railroad first mortgage four and one-half per cent bonds, due in 1957. The notes are convertible at par at the pleasure of the holder at maturity or on any prior redemption date into the Hudson and Manhattan bonds at ninety-five and interest. There are now outstanding, including the present issue, $24,000,000 of the six per cent notes. The present issue provides for all obligations of the Hudson Company maturing this year and for advances to the railroad company for the completion of its lines. With this issue the financial position of the Hudson company is as follows:

Real estate equities, including Gimble store	$4,500,000
Hudson & Manhattan R. R. 4½ per cent bonds	27,032,000
Preferred stock	2,229,251
Common stock	27,186,203
Total	$70,947,434

DIVIDENDS

Chicago Telephone Company; quarterly dividend of $2, payable March 31.

American Railways Company; quarterly dividend of one and one-half per cent, payable March 15.

El Paso Electric Company; an initial semiannual dividend of $2 per share on the common stock, payable March 15 to stock of record February 28.

NEW YORK.

	Feb. 21	Feb. 14
Allis-Chalmers common	12⅜	11½
Allis-Chalmers preferred	42½	41
Amalgamater Copper	76⅜	76¼
American Tel. & Cable	*80	*80
American Tel. & Tel.	137⅜	137
Brooklyn Rapid Transit	73⅝	71⅜
General Electric	155⅛	151½
Interborough-Metropolitan common	22¼	20¼
Interborough-Metropolitan preferred	55⅜	50
Kings County Electric	129	130
Mackay Companies (Postal Telegraph and Cables) common	89	88½
Mackay Companies (Postal Telegraph and Cables) preferred	76	76
Manhattan Elevated	135	137
Metropolitan Street Railway	16	17½
New York & New Jersey Telephone	123	123¼
U. S. Steel common	80½	78¾
U. S. Steel preferred	120	119⅝
Western Union	72½	71
Westinghouse common	69	68½
Westinghouse preferred	125	125

*Last price quoted.

BOSTON.

	Feb. 21	Feb. 14
American Tel. & Tel.	137⅜	137
Edison Elec. Illuminating	248	241
General Electric	155¼	156
Massachusetts Electric common	17⅜	19
Massachusetts Electric preferred	83	80
New England Telephone	136	134
Western Tel. & Tel. common	14	15
Western Tel. & Tel. preferred	88½	89

PHILADELPHIA.

	Feb. 21	Feb. 14
American Railways	46¼	46⅜
Electric Company of America	11⅜	11⅝
Elecrtic Storage Battery common	59	57¼
Electric Storage Battery preferred	59	57¼
Philadelphia Electric	15¼	14½
Philadelphia Rapid Transit	25⅞	26
Philadelphia Traction	89	89
Union Traction	51	50

CHICAGO.

	Feb. 21	Feb. 14
Chicago Railways, Series 1	105	105
Chicago Railways, Series 2	30	29¼
Chicago Subway	3¼	3¼
Chicago Telephone	128½	127
Commonwealth Edison	115	114
Metropolitan Elevated Common	16	15½
Metropolitan Elevated preferred	51	51
National Carbon common	106	105
National Carbon preferred	118	115

PERSONAL MENTION.

DR. FREDERICK BEDELL, of the department of physics, at Cornell University, will spend the remainder of the year abroad on sabbatic leave.

J. C. BARCLAY, for several years assistant general manager of the Western Union Telegraph Company, has resigned to enter other business.

W. G. EVANS, president of the Denver City Tramway Company, who has been visiting Paris, returned to New York recently on the steamer George Washington.

J. D. MORTIMER has been elected vice-president, to succeed C. D. Wetmore, and secretary, to succeed S. W. Burt, of the Milwaukee Electric Railway and Light Company and the Milwaukee Light, Heat and Traction Company.

MILTON TRUEMAN, for several years trainmaster on the Lake Shore Electric Railroad, has been promoted to the position of superintendent of the Toledo division of that road. He has been with the company ever since the road was built.

A. D. MILLER, formerly with the Nevada Transit Company, will become the manager of the Central California Traction Company. The Central California Traction Company is building a line between Sacramento and Stockton, which will be in operation about the middle of July.

J. AUSTIN GREENIDGE has resigned as general manager of the Utica Gas and Electric Company, a position which he has held for the past eight years. After March 1, when his resignation takes effect, Mr. Greenidge will be connected with J. G. White & Company, of New York city.

SAMUEL E. HUENERFAUTH, who has been superintendent and more recently a traveling representative of the Ideal Electric and Manufacturing Company, of Mansfield, O., has resigned his position and accepted a position as superintendent of a large electrical factory in Chicago. The resignation becomes effective March 1 and Mr. Huenerfauth will enter upon the duties of his new position with the Chicago factory at that time.

H. B. KIRKLAND, one of the best-known electrical men in the fraternity, has been appointed general sales manager of the American Conduit Manufacturing Company. It has been a source of delight to a host of friends and close acquaintances to find Mr. Kirkland restored to health and actively engaged with this progressive company. His great knowledge of this field and his wide acquaintance will make him a tower of strength in the organization. Mr. Kirkland is making his headquarters at the general offices of the company, Keystone Building, Pittsburg, Pa.

BELVIDERE BROOKS, of New York city, was, on February 16, chosen by the board of directors as general manager of the Western Union Telegraph system. Since the first years of Mr. Brooks' service for the Western Union company, when he was pointed out as the youngest operator in the world, his advancement has been continuous. Forty years ago, beginning as messenger boy, he was promoted to a position as operator, then to office manager in a Texas city, later becoming office manager at Galveston, Tex. For twelve years he was assistant superintendent of one of the western divisions, with headquarters at Denver. In 1902 he was made superintendent of the eastern division, in which capacity he was acting at the time of his present promotion.

JOHN W. LIEB, JR.

JOHN W. LIEB, JR., third vice-president of the New York Edison Company, was the guest of honor at a dinner given him at Delmonico's in New York city on Friday evening, February 11, by the staff council of the New York Edison Company in honor of the fiftieth anniversary of his birth. Thomas E. Murray presided, and in a very appropriate speech on behalf of the council, presented Mr. Lieb with a complete set of the "Atlantic Code" of Leonardo da Vinci as a suitable testimonial for an engineer, and, as a further mark of personal esteem, a Swiss repeating watch. Mr. Lieb responded, saying among other things, that he "believed the fulfillment of duty to your company and associates should be a higher aim than the accumulation of riches." Mr. Murray, who has a splendid tenor voice, sang several songs which were enjoyed by every one present. Among the entertainers were the Symphony Quartette, the Sicilian Quartette and E. C. Havens. Mr. Orrok, of the New York Edison Company, also gave a very fine recital. Those present at the dinner were: N. F. Brady, H. A. Campbell, W. I. Donshea, H. M. Edwards, W. W. Edwin, E. A. Harley, W. H. Lawrence, W. T. Morrison, T. E. Murray, G. A. Orrok, S. A. Rhodes, C. S. Shepard, J. P. Sparrow, Henry Stephenson, Philip Torchio, E. M. Van Norden, Arthur Williams and Joseph Williams.

OBITUARY.

FAYETTE BROWN, president of the Brown Hoisting Machinery Company, died on January 30 at the age of eighty-seven. In addition to the presidency of this company, Mr. Brown was at one time vice-president of the Kuhlman Car Company. He was also a member of a number of local clubs.

PROF. FRIEDRICH KOLRAUSCH, who has for ten years been president of the Reichsanstalt, died recently at Marburg, Germany. Professor Kolrausch, who was born in 1840, was the son of Rudolph Herman Arndt Kolrausch, himself a distinguished physicist and the collaborator of William Weber, in the first experimental researches undertaken with the object of expressing electrical quantities in mechanical measure. After a course at the Polytechnic of Cassel, and special study at Marburg and Erlangen, Professor Kolrausch received the degree of Ph. D. at Gottingen in 1863. On the resignation of Helmholtz from the presidency of the Reichsanstalt in 1895, Kolrausch was appointed his successor. He was the author of many books, the best known of these being his "Lehrbuch der Practischen Physik."

PROPOSALS.

POST OFFICE, ESTHERVILLE, IA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until March 29, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Estherville, Ia., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Estherville, Ia., or at the Supervising Architect's office.

POST OFFICE, QUINCY, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until March 28, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system), of an extension, remodeling, etc., to the United States Post Office at Quincy, Ill., in accordance with the drawings and specifications, copies of which may be obtained from the custodian at Quincy, Ill., or at the supervising architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

Date.	Article	Quantity.	Delivery at navy yard.	Sch.
March 8—	Cable, interior-communication	6,000 feet	Brooklyn, N. Y.	2271
	Clusters, 4 light, Type A	20	do	2271
	Instruments, electric measuring	21	Washington, D. C.	2273
	Insulators, electrose	100	Brooklyn, N. Y.	2271
	Tubes, stuffing, conduit	1,900	do	2271
	Wire, lighting twin conductor	60,500 feet	do	2271
	Wire, lighting, single conductor	16,050 feet	do	2271
March 29—	Drills, bench, motor-driven	8	Mare Island, Cal.	2283

NEW INCORPORATIONS.

TERRE HAUTE, IND.—John Manion Company has been incorporated with large capital to carry on the business of manufacturing electrical apparatus, and to make a specialty of electric installations. John Manion is president, and F. F. Maloney, secretary.

NEW YORK, N. Y.—The Sanitary Telephone Transmitter Company has been incorporated with a capital of $100,000, to manufacture and deal in telephones and electrical apparatus. The incorporators are: J. Tatlock, A. L. Clark and H. A. Crosby, New York city.

EVANSVILLE, IND.—The A. L. Swanson Company, recently incorporated, will manufacture and sell all kinds of electric apparatus and supplies, including telephones, and will engage in a general installation of electrical equipment. Albert L. Swanson, J. B. Rainey and H. Swanson, directors.

PENN YANN, N. Y.—The Penn Yann Flexible Conduit Company has been incorporated in Yates County for the purpose of manufacturing electrical conduits, insulators, supplies, etc. The company, which has a capital of $75,000 was incorporated by W. T. Morris, G. S. Sheppard and J. S. Wheeler, all of Penn Yann.

INDUSTRIAL ITEMS.

THE AMERICAN ELECTRICAL WORKS, Phillipsdale, R. I., manufacturers of bare and insulated electric wires, galvanized iron wire and strands, etc., is sending out a price list of German silver resistance wire.

THE OLIVER ROTOR COMPANY, 191-193 Fifth Avenue, Chicago, Ill., manufacturer of the Oliver Roto sign, is sending out a circular descriptive of this interesting device which consists of two whirling eight candlepower lamps which create a rainbow colored circle.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., will furnish the Ohio State Penitentiary with electric generating, which has already been ordered by the board of managers. The equipment will include two heavy duty cross-compound condensing engines direct connected to a 600 kilowatt, 480-volt alternator-current generator.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing another of its unique and attractive folders dealing with the lamp problem. The lamp problem is discussed in this folder from the customer's point of view. It names his requirements and explains how they can best be met by using Buckeye tungsten lamps.

THE WILLIAMSPORT GAS ENGINE WORKS, Williamsport, Pa., have reopened the plant of the Williamsport Gas Engine Company, which has been shut down during the past year, and will continue the entire line of gas and gasoline engines formerly manufactured by the old company. They are looking for active agents in all sections of the country.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, 184 Lake street, Chicago, Ill., has secured the agency for the

Franklin Manufacturing Company, Hartford, Conn., makers of incandescent lamps. The Metropolitan Company will carry a full line of the Franklin Company's products and will be able to make prompt shipments from its big Chicago stock.

THE WESTERN ELECTRIC COMPANY is distributing a booklet, neatly arranged in post-card form, which gives several convincing reasons why No. 1317 type magneto telephone sets should be used. This booklet shows illustrations of all parts of these sets and explains the qualities of each part. Also in the back of the booklet will be noted a cut of the Hawthorne plant of the company.

THE BURLINGTON LIGHT AND POWER COMPANY, Burlington, Vt., has purchased a 1,000-kilowatt Westinghouse high-pressure steam turbo generator set for its local lighting and power service. Three phase, sixty-cycle power is generated at 2300 volts, at which pressure it is served to the local distribution lines, and reduced by pole-top transformers for lighting and power in the city of Burlington.

THE LORD ELECTRIC COMPANY, New York, N. Y., thus far this year has actually sold more of its various products than in any six months of any prevous year since it has been in business. Large orders have been received for Earll trolley catchers and retrievers, controlators, lightning arresters and other specialties. The company considers such results proof of the satisfaction secured in operation.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently sent out the February number of the *Emerson Monthly*. As in all of the previous issues this one contains a large number of interesting illustrated descriptions of various apparatus being placed on the market by this firm; a comprehensive price list and a number of instructive articles dealing with recent installations.

THE STERLING ELECTRICAL MANUFACTURING COMPANY, Warren, Ohio, has made arrangements with the Johnson Electrical Company, of Omaha, Neb., to handle the entire line of Sterling lamps for Nebraska, Iowa, North and South Dakota, Wyoming and Montana. The company has also arranged with the New England Electric Company, of Denver, Col., to represent it in Denver and surrounding territory.

THE KERR TURBINE COMPANY, Wellsville, N. Y., has just issued two new bulletins, No. 9 "Turbo-Blower Units," and No. 10, "Steam Turbine Generators, Steam Turbine Centrifugal Pumps." The first bulletin illustrates practical outfits for forced and induced draft, gas works service and for furnishing blast for cupolas. The other bulletin includes generating sets for electric power and lighting, and pumping units for boiler feeding, fire service, water supply, circulating condenser water, draining pumps, and for other service where water must be delivered at moderate or high pressure or against considerable head.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., manufacturers of electric commercial vehicles, has sent out the first number of an attractive little publication entitled "Elec-Tricks," published in the interest of modern economical transportation of merchandise by electric vehicles. This little magazine of observation and comment will be published each month, and if the standard as established by the first copy is maintained it will undoubtedly be awaited with interest. A feature of the present issue is a number of photographs showing the results of the recent Eastern snow storms.

THE PITTSBURG TRANSFORMER COMPANY, Pittsburg, Pa., has recently distributed a handsome bulletin, No. 1098, devoted to Pittsburg self-cooled oil-insulated transformers. The excellent electrical performance and rugged construction of these transformers, which are made in standard sizes up to 500 kilovolt-ampere capacity, are clearly set forth in this publication and the various parts are illustrated and the method of construction described in detail. The transformers described in the bulletin are of the core type, the company having adopted this design after careful study and comparison, and they are adapted to operate upon all commercial voltages and frequencies.

DODGE & DAY, engineers, Philadelphia, Pa., have just completed a commission aggregating the expenditure of $400,000 for new buildings and improvements for the Warner Brothers Company at Bridgeport, Conn. Last March Dodge & Day were commissioned to prepare detailed plans and specifications, and to let contracts covering the construction of three large new manufacturing buildings and one large central power plant and give special attention to heating, ventilating and fire protection. On January 1, 1910, the buildings, including additions and alterations to the existing plant, were entirely completed and occupied. Dodge & Day are also just completing the construction of a reinforced concrete building for the Penn Chemical Works Philadelphia, Pa.

THE BRIDGEPORT BRASS COMPANY, Bridgeport, Conn., announces that on January 22, 1910, the sales department of this company was moved from New York to Bridgeport, where all correspondence should be addressed in the future. A new office building has been provided in which is located the general offices of the company. The centralizing of all departments at Bridgeport makes it possible to serve its customers better and more promptly than in the past. A branch office is retained at the old address in New York, corner Broadway and Murray Street, Postal Telegraph Building, where visitors are cordially invited to call whenever in New York, and also to the main office at Bridgeport, where the services of practical men in the development of mechanical matters are at the disposal of customers.

THE DEARBORN DRUG AND CHEMICAL WORKS, of Chicago, will move their general offices and chemical laboratories on May first from the Postal Telegraph Building, where they have been located since the organization of the company more than twenty years ago, to the new McCormick Building, on Michigan Boulevard and Van Buren Street. The extensive growth of the business of the company has made necessary this removal to its new home, where the general offices and laboratories will occupy the greater portion of the top floor of one of the finest office buildings in Chicago. The Dearborn company will have the entire frontage on Michigan Boulevard for its offices and laboratories, with a total floor space of more than 5,000 square feet. The company extends a cordial invitation to old and new friends to visit the new headquarters, where a mass of valuable information can be obtained pertaining to the successful treatment of boiler feed waters.

DATES AHEAD.

Minnesota Electrical Association annual convention, Minneapolis, Minn., March 29, 30 and 31.

Missouri Electric, Gas, Steel Railway and Water Works Association, next convention at Jefferson City, Mo., on April 14, 15 and 16.

Florida Electric Light and Power Association, next meeting at Tampa, Fla., April 21.

Iowa Electrical Association and Iowa Street and Interurban Railway Association, annual conventions, Sioux City, Ia., April 20 and 21.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) February 15, 1910.

949,004. METHOD OF RECOVERING IRON FROM ORES AND PREPARING IRON ALLOYS. Alexander S. Ramage, Newark, N. J., assignor to The Electric Steel Company of Canada, Limited, Welland, Ontario, Canada. Filed August 21, 1909. The method of recovering iron from ores consists in reducing the ore and preparing an iron sponge substantially free from carbon, and electrolytically refining the sponge.

949,012. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed March 7, 1903. The busy condition of the jacks may be ascertained from the condition of the test contacts of the multiple jacks in the various positions.

949,016. ELECTROLYTIC APPARATUS FOR RECOVERING METALS FROM SOLUTIONS. Wilbur A. Hendryx, Denver, Colo. Filed April 23, 1906. A revolving drum having a filter in the inlet end and a screen in both ends, contains the anode and cathode.

949,033. ELECTRICAL SWITCH. John D. Hilliard, Albany, N. Y. Filed March 19,1908. Describes a form of oil switch.

949,041. APPARATUS FOR SEPARATION OF PARTICLES FROM A FLUID STREAM. Lawrence N. Morscher, Enterprise, Kans., assignor to William J. Ehrsam and Lawrence N. Morscher, co-trustees, Enterprise, Kans. Filed May 31, 1907. There are two electrodes, one movable and the other adapted to discharge toward the movable electrode. A particle-laden fluid stream is driven between the two electrodes in the direction of movement of the movable electrode.

949,058. PROCESS FOR THE TREATMENT OF SILVER-NICKEL-COBALT-ARSENIC ORES. Camillo C. Cito, Irvington, N. J. Filed October 13, 1909. The process of treating a silver-nickel-cobalt-arsenic ore free from lead, consists in first, smelting the ore in the presence of copper to produce an alloy containing besides the copper, all the silver, nickel and cobalt and nearly all the arsenic, and second, separating the metals by electrolysis from an anode of the alloy.

949,072. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. William T. Hensley, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed May 4, 1908. The brush-holder comprises a box, a carbon brush movably supported therein, a supporting arm integral with the box, a resilient brush-engaging finger bent into the form of an open ring or loop, a rigid finger projection within

the loop of the resilient finger and a pressure mechanism for forcing the extremity of the resilient finger into engagement with the outer end of the brush.

949,081. ELECTRIC-ARC LAMP. John C. Lincoln, Cleveland, Ohio, assignor to The Lincoln Company, Cleveland, Ohio. Filed January 16, 1905. A stationary tubular iron field-structure is relatively more massive in its upper portion, whereby the lifting effect of the armature is maintained substantially in proportion to the supported weight.

949,082. FIELD-MAGNET FOR DYNAMO-ELECTRIC MACHINES. Emil Mattman, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed January 28, 1907. The field magnet comprises a pole piece, a series coil adjacent the armature end of the pole, a superposed shunt coil, a coil seat supporting the series coil, and spacing devices resting on the seat and extending between the pole and series coil and between the series and shunt coils.

949,086. TRANSFORMER-CASE CONSTRUCTION. Louis C. Nichols, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed October 19, 1905. Surrounding the oil-filled transformer casing is a water jacket for cooling purposes.

949,097. MOTOR-CONTROL SYSTEM. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed April 1, 1908. The system comprises an electrically operated controller for making and breaking the motor circuits and varying the resistance thereof in a plurality of independent steps, and a manually operated combined series-parallel switch and master controller.

949,103. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Miles Walker, Manchester, England, assignor to Westinghouse Electric & Manufacturing Company. Filed February 2, 1907. The commutator cylinder has peripheral grooves, the side walls of which constitute contact surfaces, and insulated clamping bands located in the bottom of some or all the grooves.

949,106. DYNAMO-ELECTRIC MACHINE. Edwin C. Wright, Newport, Ky., assignor to The Bullock Electric Manufacturing Company. Filed January 22, 1906. There is an auxiliary field winding for reducing sparking at the brushes, this winding being connected in shunt to the armature winding and electromagnetic responsive means are provided for varying the current in the auxiliary winding substantially in direct proportion to variations in the armature current.

949,111. ROTATING SIGN-ILLUMINATING DEVICE. Frank M. Carter, Oakland, Cal. Filed November 11, 1908. The electric circuit is made through pivot pins and contacts.

949,114. SYSTEM OF ELECTRIC-MOTOR CONTROL. William Cooper, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed May 4, 1908. In combination with a plurality of motors connected in series pairs, each pair having a different current-carrying capacity, is bridging conductor or cross connection permanently joining intermediate points of equi-potential in the pairs.

949,122. ELECTRIC-CLOCK-SYNCHRONIZING APARATUS. Ernest A. Hummel, St. Paul, Minn., assignor to Albert L. Haman, St. Paul, Minn. Filed February 23, 1907. An electrically operated arm is brought periodically into locking engagement with a sleeve supported on the minute-hand arbor and yieldingly engaging the same.

949,123. ELECTRIC SWITCH. Charles J. Klein, New York, N. Y., assignor to Ida S. Roseheim, New York, N. Y. Filed July 25, 1907. A downwardly extending flange surrounding the aperture in a faceplate, acts as a guide for a block.

949,130. POLE-LINE LIGHTNING-ARRESTER. Alfonso R. Rheinberger, St. Paul, Minn. Filed October 7, 1908. In combination with an insulating pin and an insulator mounted thereon having means for holding a line, are two electrodes, one being mounted upon the insulator and connected with the line and the other mounted upon the pin and connected with ground, these electrodes being spaced apart to form an air gap across which oscillatory discharges are adapted to jump.

949,138. IGNITION DEVICE. Baxter M. Alakson, Salem, Ohio. Filed January 14, 1908. Describes a dynamo-electric device.

949,146. SECONDARY OR STORAGE BATTERY. Charles H. Clare, Stratham, N. H. Filed May 4, 1908. A frame for storage battery has therein a plurality of openings, active material adapted to become active during the operation of the battery applied to the surfaces of the openings, and means within each opening and co-operating with the frame at the ends of the openings for holding the material in place, and also to permit of an exciting fluid having access through the same to the material.

949,151. ELECTRIC-ARC LAMP. John C. Lincoln, Cleveland, Ohio, assignor to The Lincoln Company, Cleveland, Ohio. Filed January 31, 1905. Provision is made for partially checking or damping the movement of the carbon holder.

949,153. METALLIC-FILAMENT INCANDESCENT LAMP. Wilhelm Majert, Berlin, Germany. Filed May 15, 1909. There are base supports, tip supports and resilient middle supports, filament loops of high-fusing brittle metal having their tips engaged by the middle supports and thereby sprung laterally and their ends engaged by the base supports to form a single layer of non-intersecting filaments in elastically sprung condition.

949,159. DEVICE FOR APPLYING STERILIZERS TO MOUTHPIECES. Orrin H. Savage, New York, N. Y., assignor to Oakville Company, Waterbury, Conn. Filed December 5, 1906. A body member of frusto-conical form extends within the mouthpiece and is provided with absorbent material to press against the inner wall of the mouthpiece.

949,182. HIGH-POTENTIAL SWITCH. Frank O. Hartman, Mansfield, Ohio. Filed Dec. 17, 1906. A high potential oil switch for electric currents comprises a plurality of switch elements, a supporting frame for such switch elements consisting of a standard and a horizontally projecting tubular frame attached to the same, and means of operating the movable members of such switch elements simultaneously.

949,184. INSULATOR FOR HIGH-POTENTIAL CIRCUITS. Joseph N. Kelman, Los Angeles, Cal. Filed February 10, 1908. The insulator consists of a spreading member and tube composed of laminas or layers of flexible fabric, these layers of fabric being separated by insulating varnish with which the fabric is covered and impregnated.

949,187. TRANSMISSION SYSTEM. Otto T. Lademan, Milwaukee, Wis., assignor to Railway Telephone & Electric Company, Chicago, Ill. Filed February 15, 1909. Describes a telephone transmission system.

949,188. COMPOSITE SYSTEM. Otto T. Lademan, Milwaukee, Wis., assignor to Railway Telephone & Electric Company, Chicago, Ill. Filed February 15, 1909. Describes a composite system of telephony and telegraphy.

949,209. ELECTRIC-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed October 17, 1904. A yoke attached to the front of the lamp receptacle is held between the cover and the box.

949,225. SECONDARY OR STORAGE BATTERY. Bruce Ford, Philadelphia, Pa. Filed April 22, 1908. The battery box has an expansion joint in its bottom.

949,235. TELEPHONE SELECTING SYSTEM. David W. Jones, Dora, Tex. Filed February 1, 1909. Includes a magneto generator and a circle of contact points (contacting with stationary brushes) carried by a gear of a train of spring-driven gearing controlled by a clock escapement which is intermittently operated by electromagnets.

949,243. CONNECTING DEVICE FOR CIRCUIT-WIRE COVERING PIPES. Thomas E. Murray, New York, N. Y. Filed July 24, 1909. In combination with a circuit conductor and inclosing pipes therein separated at their ends by an interval, are metal rings receiving opposite ends of the pipes and a bar extending across the interval and uniting the rings.

949,251. VARIABLE-RATIO ROTARY CONVERTER. Joseph L. Woodbridge, Philadelphia, Pa. Filed February 17, 1908. An armature provided with alternating current terminals, a commutator and appropriate direct current brushes for producing in the amature between the contact points of adjacent direct current brushes, a magnetic flux adapted to develop a primary alternating current electro-motive-force; also for producing between the same contact points a second automatically varying magnetic flux adapted to develop a secondary alternating current electro-motive-force displaced from the first and such that at its mean value it will with the primary electro-motive-force produce a resultant displaced substantially ninety electrical degrees from the line of the secondary electro-motive-force.

949,256. PRIMARY BATTERY. William C. Banks, New York, N. Y. Filed July 29, 1907. A battery element, composed of a malleable iron plate having apertures disposed generally therein and extending through the plate. A series of compressed oxide of copper plugs are forced under intense pressure into these apertures.

949,263. ELECTRIC SWITCH. Leonard P. Coulter, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed March 14, 1907. Describes a manually operated switch, the arm of which may be held in any position, to which it may be moved, by means of an automatically operated electromagnet.

949,283. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed March 27, 1909. Describes an electric cut-out.

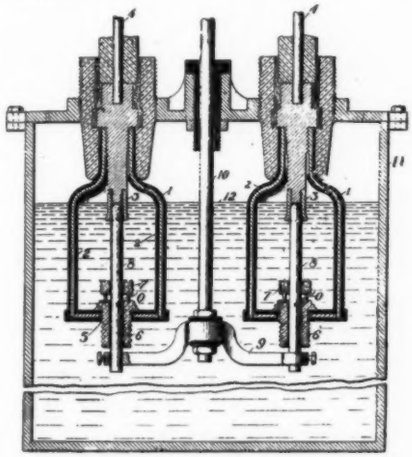
949,296. FUSE FOR ELECTRIC CIRCUITS. Conrad J. Dorff, Chicago, Ill., assignor to The Harvard Electric Company, Chicago, Ill. Filed October 28, 1907. A fuse for electric circuits, comprising a supporting strip of insulating material with sheet-metal terminals at the ends and a fuse wire extending between the terminals. One of the two sheets of insulating material, forming the strip, is provided with an elongated slot to constitute a receiving channel for the fuse wire.

949,305. DYNAMO-ELECTRIC MACHINE. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. Filed October 27, 1905. A dynamo electric machine, having a rotating core body having under-cut slots formed in its periphery extending parallel to the axis of rotation, and ribs or projections entering each of the slots, some of the ribs abutting against adjacent ribs, and others being separated from the adjacent ribs by coil receiving spaces.

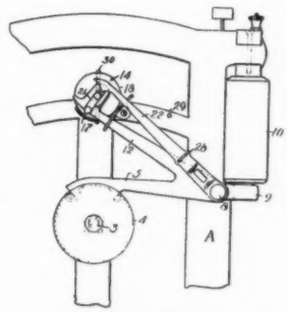
949,322. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenctady, N. Y., assignor to General Electric Company. Filed July 19, 1904. Describes a block-signal system operated on an alternating-current circuit.

949,333. ELECTRICAL CONTROLLER. Frank L. Sessions, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company. Original application filed December 12, 1907. Divided and this application filed February 5, 1909. Describes an electrical controller consisting of the combination of a fire-proof casing, resistance coils and contact points. The contact arm is pivotally mounted and adapted to engage the contact points. The operating lever is pivotally mounted in a wall of the casing, its pivotal axis being in line with the pivotal axis of the contact arm. Connections are provided whereby the operating lever may engage the contact arm.

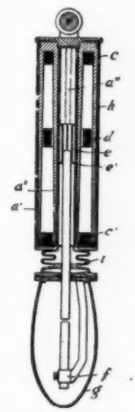
949,335. VAPOR-ELECTRIC-LAMP CIRCUIT. Percy H. Thomas, Montclair, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed January 27, 1905. An alternating-current vapor device having two positive and two negative electrodes.



949,033.—ELECTRICAL SWITCH.



949,122.—ELECTRICAL-CLOCK-SYNCHRONIZING APPARATUS.



949,151. — ELECTRIC ARC LAMP.

949,345. DYNAMO-ELECTRIC MACHINE. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed October 14, 1907. A dynamo-electric machine provided with a shaft over which is a slotted sleeve surrounded by a laminated armature core. A plurality of armature windings are carried in the slots of the core and conductors are carried in the slots of the sleeve, each connected at its opposite ends with coils of different windings.

949,353. ARC-LAMP. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed May 27, 1905. An arc lamp, having a fixed negative consuming electrode giving a flaming or luminous arc, a floating positive non-consuming electrode, and a heat radiating member carried by the latter close to the arc and arranged transversely to the direction of movement of the electrode so as to serve as a damping device.

949,363. INCANDESCENT-LAMP SOCKETS. Walter H. Perkins, Cheshire, Conn., assignor to The Waterbury Mfg. Co., Waterbury, Conn. Filed May 3, 1909. Describes an incandescent lamp socket.

949,386. METHOD FOR THE PRODUCTION OF SILICON CARBID. Frank J. Tone, Niagara Falls, N. Y., assignor to The Carborundum Company. Filed April 25, 1908. A method of producing transparent crystals of silicon carbid, which consists in subjecting a mixture of silica and carbon substantially free from natural impurities to electrically developed heat, forming thereby crystalline silicon carbid, and prolonging the operation sufficiently to form silicon vapor and to permit carbon monoxid and silicon vapor to combine as silicon carbid upon initially formed crystals, thereby building up transparent crystals of increased size.

949,404. ELECTRIC-RAILWAY SWITCH. Harry W. Sheehy, Akron, Ohio. Filed December 15, 1908. The combination with a switch point, and electro-magnets arranged for controlling the movements thereof, of circuit closing devices for the electro-magnets, consisting of vertically movable plungers, each of which embodies a pair of spaced bars.

949,419. ELECTRIC-LAMP CLEANER. Edward E. Edgerton, Chicago, Ill. Filed June 1, 1909. A globe cleaning device comprising pivoted jaws which are operated by a pawl and rachet arrangement.

949,426. JUNCTION-BOX. William J. Graham, Toronto, Ontario, Canada. Filed June 11, 1907. A junction box for combined gas and electric fixtures, comprising a base lined inside with insulating material, a central tube opening through the base and covered externally with an insulating sleeve, connecting bars secured to the base by insulated screws and extending up outside said sleeve, binding posts at the inner ends of the bars, a flanged screw connection piece threaded into the central tube and having a threaded passageway communicating with it, binding posts insulated from the flange, and securing means for the posts insulated from the flange but extending therethrough to engage with the outer ends of the connecting bars when the connection piece is screwed in place.

949,451. ELECTRIC BURGLAR-ALARM FOR VAULTS, SAFES, OR THE LIKE. Enrico Seragnoli, Arenzano, Italy. Filed October 14, 1908. Describes an electro-pneumatic alarm system.

949,465. ANTIPHASE REVERSING DEVICE. William N. Dickinson, Jr., New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed July 3, 1906. The combination with a motor comprising a frame having a limited revoluble movement of a main line switch, tripping apparatus therefor, reversing switches, auxiliary switches co-operating with said reversing switches, and safety switches operated by the revoluble frame of the motor and coacting with said auxiliary switches to effect the operation of the tripping apparatus when the motor turns in a wrong direction for elevator systems.

949,506. ART OR REJUVENATING STORAGE BATTERIES. Alfred O. Tate, Toronto, Ontario, Canada. Filed May 12, 1908. Describes a method of renewing a depleted storage battery cell by reducing the oxidized anodes to metallic lead and simultaneously oxidizing the metallic lead cathodes until they shall have resumed their original efficiency.

949,511. ELECTRIC FURNACE. Charles A. Weeks, Philadelphia, Pa. Filed September 3, 1908. An electric furnace provided with an inclosed furnace chamber having walls constituting a retaining hearth affixed thereto, trunnions in respect to which said chamber is revoluble about a horizontal axis and which are provided with a passage or opening, means for revolving said body to interchange the roof and hearth, electrodes projecting axially into the furnace chamber, and a condenser connected with said passage or opening.

949,517. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. David E. Bown, Pittsburg, Pa. Filed February 16, 1909. Describes a socket for incandescent electric lamps, the cap of which may be locked to the casing.

949,518. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass. Filed May 6, 1909. A space telegraph transmitting system comprising in combination an elevated transmitting conductor, a sonorous circuit, including a condenser associated with the elevated transmitting conductor, a source of alternating current of definite frequency, an open magnetic-circuit transformer having its primary connected with the source of alternating current and its secondary connected with the sonorous circuit, and a straight sub-divided iron-core for transformer, the

primary and secondary being arranged in tandem along the core and having such spatial separation that the circuit which includes the secondary and the condenser is resonant to the frequency.

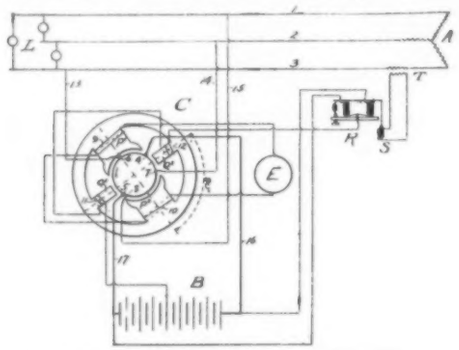
949,533. CLUSTER LAMP-SOCKET. Charles D. Gervin, New York, N. Y., assignor to John H. Dale, New York, N. Y. Filed March 16, 1908. A cluster socket, consisting of the supporting base, a plurality of yielding tongues depending therefrom, a central conductor applied to the tongues so as to be supported thereby, and a plurality of lamp holding devices secured to the conductor.

949,534. SYSTEM OF ELECTRIC DISTRIBUTION. Adelbert W. Gray, New York, N. Y. Filed September 9, 1905. Describes a system of electrical distribution embodying a series of storage batteries in parallel circuit with one another, and all in direct circuit with a generator.

949,541. CLUSTER-SOCKET. Edward A. Lefèbre, Jr., New York, N. Y., assignor to John H. Dale, New York, N. Y. Filed July 19, 1907. A multiple cluster socket comprising threaded shells, a ring and a plate separate from and coaxial with one another and attached to the shells, and a basket forming a central terminal and attached to the ring and insulated therefrom.

949,565. LIGHTNING-ARRESTER. George W. Clark, Grand Rapids, Mich., assignor of one-half to James B. Doyle, Grand Rapids, Mich. Filed March 20, 1908. Describes a lightning arrester comprising two pairs of diverging terminals arranged in series between a line conductor and a ground conductor and spaced apart unequally.

949,593. AUTOMATIC CIRCUIT-CLOSER. Thomas W. McKenzie, Hammond, British Columbia, Canada. Filed August 25, 1909. The combination with a telegraph key, of an automatic circuit closer connected in circuit with the telegraph key and mounted



949,251—VARIABLE-RATIO CONVERTER.

independent of the key, the circuit closer having a movable contact member and the key having a projection to engage the contact member to move it in one direction as the key is depressed.

949,604. SYSTEM OF INSULATION. Louis Steinberger, New York, N. Y. Filed December 5, 1909. A system of insulation, comprising a plurality of thimble type insulators and a plurality of rod type insulators connected together in the form of a continuous chain.

949,628. CONDUIT-OUTLET. Harold A. Gilbert, New York, N. Y. Filed June 24, 1909. Describes an easily attached fitting.

949,630. ELECTRIC FUSE-PLUG. John H. Hanson, Chicago, Ill. Filed December 21, 1908. A fuse plug having a socket base with an end aperture, a rim, and a detachable fuse wire enlarged at one end to provide an integral flat head, said wire passing through the aperture in the end of the socket and removably connected to the rim, the head of the wire constituting the center contact of the plug.

949,690. MEANS FOR ATTACHING TELEGRAPHONE-CONTROL MECHANISM TO TELEPHONES. Wilbur H. Thompson, Wheeling, W. Va. Filed April 8, 1908. The combination of an inter-communicating telephone system, a telegraphone comprising a record and a reproducing magnet, and switching mechanism adapted to connect the recording magnet with the telephone line and the reproducing magnet with the receiver of the telephone line.

949,699. SIGNAL-BOX. Herman W. Doughty and Clarence E. Beach, Binghampton, N. Y., assignors to Star Electric Company. Filed October 16, 1900. Describes the mechanism of a signal box.

949,704. ATTACHMENT-PLUG FOR ENGINE-CYLINDERS. Nevil M. Hopkins, Washington, D. C., assignor to The Electric Speedometer and Dynamometer Manufacturing Company, Washington, D. C. Filed June 23, 1909. A spark-plug comprising an insulating bushing, an electrode-wire passing therethrough, the bushing having an opening therethrough of different diameters, a silica tube having portions corresponding with the different diameters, a packing between the thus formed shoulders on the bushing and tube, and a spring for holding the parts in place.

949,726. ELECTRIC INSULATOR. Harold W. Eden, Detroit, Mich., assignor to P. R. Manufacturing Company, Detroit, Mich. Filed December 7, 1908. An electrical insulating device, having in combination with a dished base plate, having an aperture therethrough, a perforated metal disk provided with a depending neck portion adapted to depend into said apertured portion of the base plate, a binding nut adapted to rest on said disk, a holding screw adapted to extend from beneath through said neck portion of the disk and said apertured portion of the base plate.

949,740. ALTERNATING-CURRENT ELEVATOR APPARATUS. David Larson, Yonkers, N. Y. Filed December 19, 1905. Renewed May 24, 1907. A single-phase alternating current motor, a reversing switch therefor arranged to be actuated by a single-phase current, a single-phase brake and a single-phase controlling device, the motor, reversing switch, brake and controlling device arranged to be concurrently energized during the run of the motor.

949,743. GROUND-WIRE CONNECTOR. Francis E. McKenna, Wauwatosa, Wis., assignor of one-half to Henry B. Burr, Milwaukee, Wis. Filed November 23, 1908. A ground wire connector, comprising a bolt, a flexible metal strip with one end connected to the bolt, and a pair of plates on the bolt, one of the plates being provided with a slot through which the free end of the strip may pass and be clamped between the faces of the two plates when the bolt is tightened to stretch the strip.

REISSUE.

13,083. SECONDARY-BATTERY PLATE. William Morrison, Des Moines, Iowa, assignor to The Westinghouse Storage Battery Company. Filed December 8, 1909. Original No. 916,576, dated March 30, 1909. A storage battery plate having an active material comprising oxid of lead, sulfuric acid, water, ammonium sulfate, and barium sulfate.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 21, 1910:

491,978. WORKMAN'S TIME RECORDER. Frank H. Bolte, Milwaukee, Wis.

491,982. ELECTRIC MOTOR AND CONTROLLING APPARATUS FOR CARS. John V. Capek, New York, N. Y.

491,988. ELECTRIC RAILWAY TROLLEY. Alfred Dickinson, Darlaston, England.

491,990. MULTIPOLAR DYNAMO-ELECTRIC MACHINE ARMATURE. Geo. E. Dorman, Chicago, Ill.

491,992. CUT-OUT FOR INCANDESCENT ELECTRIC LAMPS. Thomas A. Edison, Llewellyn Park, N. J.

492,008. POLE STANDARD FOR ARC LAMPS. Frederick D'A. Goold, Schenectady, N. Y.

492,011. ELECTRICAL INDICATOR. Henry J. Haight, New York, N. Y.

492,019. MAGNETO TELEPHONE SWITCH. Wm. Humans, Cambridge, Mass.

492,036. AUTOMATIC CIRCUIT-BREAKER FOR MOTORS. Robert T. Lozier, New York, N. Y.

492,110. AUTOMATIC INDIVIDUAL TELEPHONE CALL APPARATUS. Joseph Sack, Berlin, Germany.

492,124. DUPLEX ELECTRIC ARC LAMP. Barton B. Ward, New York, N. Y.

492,151. DYNAMO-ELECTRIC MACHINE. Wallace E. Freeman, Long Island City, N. Y.

492,160. ELECTRIC ELEVATOR. Frank E. Herdman, Indianapolis, Ind.

492,173. COMMUTATOR FOR DYNAMOS OR MOTORS. Joseph A. Williams, Cleveland, Ohio.

492,200. ELECTRIC ARC LAMP. Henry Harper, London, England.

492,215. HANGER FOR ELECTRIC INCANDESCENT LAMPS. Samuel O. Larkins, Blair, Neb.

492,219. LIGHTNING CONDUCTOR AND ARRESTER. Adelvin B. Lyman, Cleveland, Ohio.

492,244. METHOD OF CONSTRUCTING ARMATURE CORES FOR ELECTRIC MOTORS OR DYNAMOS. Albert W. Smith, San Francisco, Cal.

492,245. MAGNETIC TOOL. Jacob F. Standiford, Muscogee, Ind. Ter.

492,247. ELECTRICAL FOOT WARMER. Wm. E. Ulmer, Hoquiam, Wash.

492,265. CONDUIT ELECTRIC RAILWAY. Fred W. Brann, Oakland Cal.

492,291. COMMUTATING APPARATUS FOR DYNAMO-ELECTRIC MACHINES. Edward J. Houghton and Wm. White, London, England.

492,309. ELECTRIC BELL ALARM. Gustaf L. Reenstierna, Boston, Mass.

492,330. ELECTRIC BURGLAR ALARM. Julius Kamsler, New York, N. Y.

492,377. ELECTRIC REDUCTION OF REFRACTORY METALLIC COMPOUNDS. Thomas L. Willson, Leaksville, N. C.